INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

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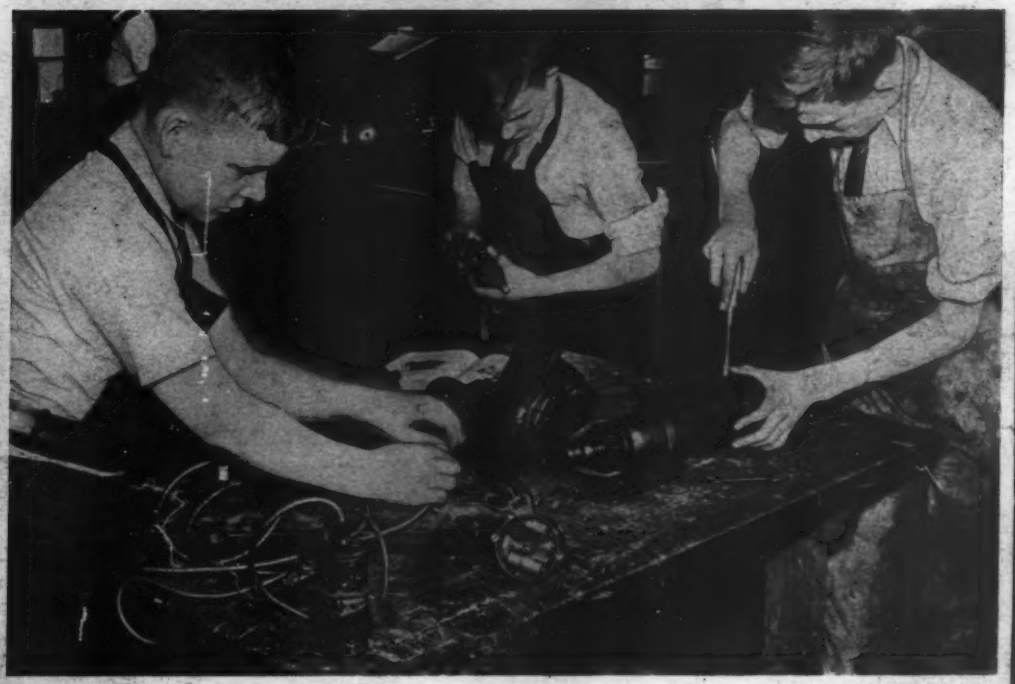

Pre-Convention Number

DECEMBER, 1943 VOL. 32, No. 10

A NEW ATOM SORTER

...AND A TRUTH IT REVEALS

Westinghouse Electric & Mfg. Co. Photo

MOST men would call it new—this mass spectrometer which, by measuring the distance a charged particle can jump, reveals the energy required to break up a molecule, the location of petroleum deposits, or the distribution of "heavy" atoms in a living body. Yet the designer himself would be the first to tell you that this atom sorter depends on discoveries made by Dalton 140 years ago, on researches at least 40 years old, and on a simpler instrument devised in 1918.

Thus it is and thus it will always be. It isn't what you have; it's what you do with it that counts. So it is with the qualities in men. All men have the desire to succeed. All men possess energy and latent abilities. But some men are purposeful . . . take measured and directed steps toward their goal . . . develop the *habit* of achievement. Others do not.

Here is the *great* difference between men. Educators know this and never ignore any opportunity to fan into flame the spark of achievement that resides in the breast of *every* boy they meet. The opportunity to discharge this responsibility is always present in the teaching of mechanical drafting. Here the world of future manhood draws close and touches the world of boyish fancy. Here within reach of youth's enthusiasm lie the disciplines which lead to achievement in any field. Here, standards and values of honest craftsmanship can be set . . . to serve for a lifetime.

To grasp this opportunity, instructors who are true *educators* insist that their students be provided with the finest drawing instruments it is possible to afford. Not simply because pride of ownership is valuable at this time; not simply because good instruments will serve their owner all his life; but because instruments carelessly chosen lead to a subject carelessly regarded, and betray a lack of sincerity any boy is quick to detect. *Good* drawing instruments are an investment that is repaid many times over the years of a more productive life.

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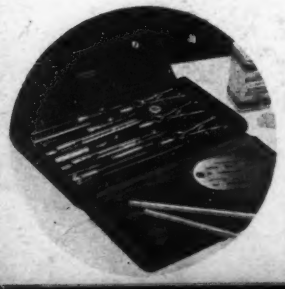

Army-Navy "E" Production Award for Excellence in Manufacturing, Drafting and Surveying Instruments and Supplies for the Armed Services of the United States.

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Be First ON THE POST-WAR PRIORITY LIST

Post-war employment and prosperity depend upon quick resumption of normal peace time civilian activities, production, and services. To furnish lathes first to those who will be ready to use them (but cannot qualify for a war-time priority) South Bend Lathe Works now offers a practical post-war priority plan.

To take advantage of this plan, place an order now for the lathes you want. No down payment, no deposit is required. Should conditions necessitate, you may cancel the order at any time. All we ask is that it be placed in good faith.

When your order is received, we will issue a numbered Post-war Priority Certificate. As soon as materials and manpower are released for civilian production, South Bend Lathes will be shipped in accordance with the Priority Certificates. Certificate holders will receive the first South Bend Lathes to be thus released, up to 80% of our production. The remaining 20% will be reserved for returning service men who may need lathes.

All standard South Bend Lathes, embodying the improvements developed in meeting exacting war production needs, will be available. No revolutionary models or design changes are to be expected. There will be no price increase — unless material or labor costs, or other conditions beyond our control, require it.

Here is a practical first step in putting your post-war plans into action. Send for Catalog No. 100-C and full information on this plan. Choose the lathes that meet your needs... place an order now, and be sure of earliest possible delivery.

South Bend Engine Lathes and Toolroom Lathes are made in five sizes: 9", 10", 13", 14½", and 16" swings, with bed lengths from 3' to 12'. The Turret Lathes are made with 9" and 10" swings. They are illustrated and described in Catalog No. 100-C.

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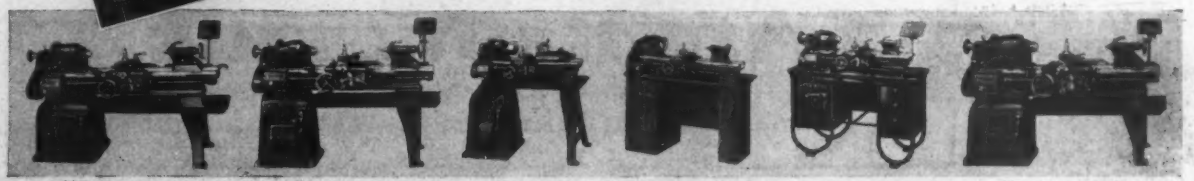

14½" South Bend Lathe Bed Lengths: 5' to 10' | 13" South Bend Lathe Bed Lengths: 4' to 7' | Series 1000 South Bend Turret Lathe, 10" Swing | 9" South Bend Lathe Bed Lengths: 3' to 4½' | 10" South Bend Lathe Bed Lengths: 3' to 4½' | 16" South Bend Lathe Bed Lengths: 6' to 12'

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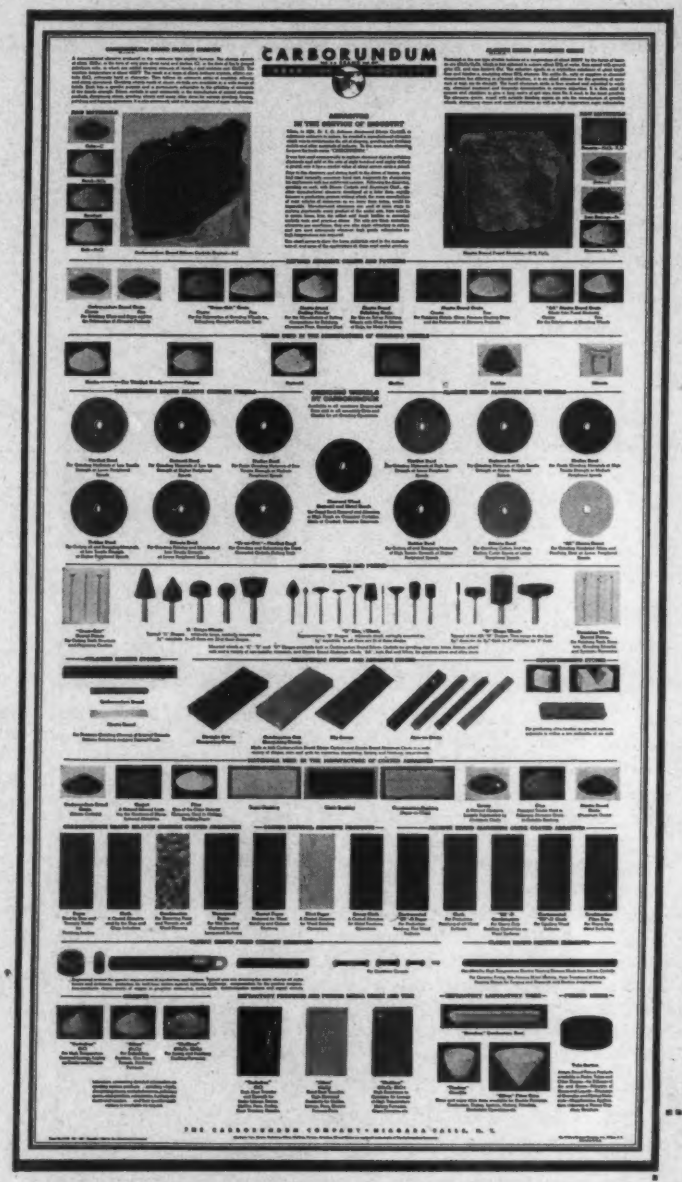

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INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, December, 1943, Volume 32, No. 10. Published monthly, except during July and August, by The Bruce Publishing Co., Milwaukee 1, Wis. Entered January 2, 1914, as Second-Class matter at Milwaukee 1, Wis., under Act of March 3, 1879. Subscriptions — U. S., $2.50 per year. Canada and Foreign, $3.00. Single copies, 35 cents.

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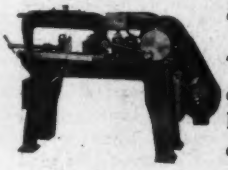

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This "Dry Cut" Saw, without the coolant equipment, cuts at slightly lower speeds. Other features and capacities identical.

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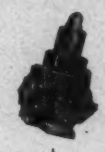

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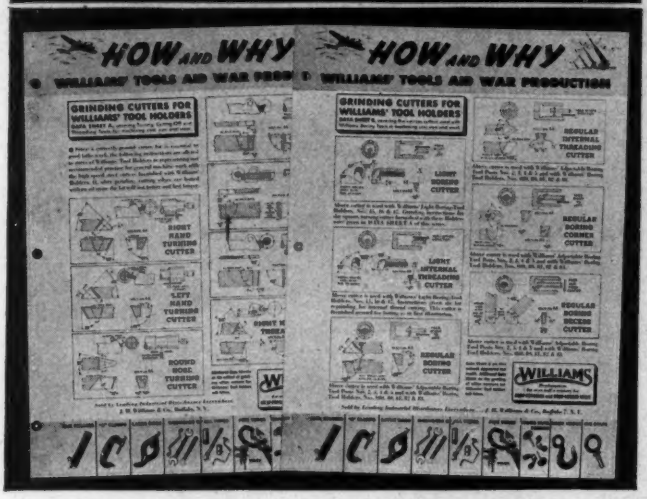

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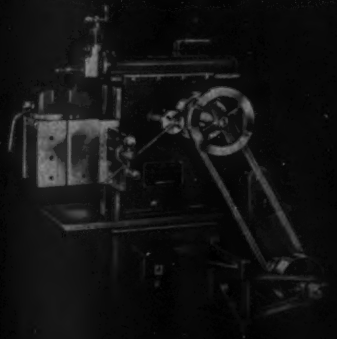

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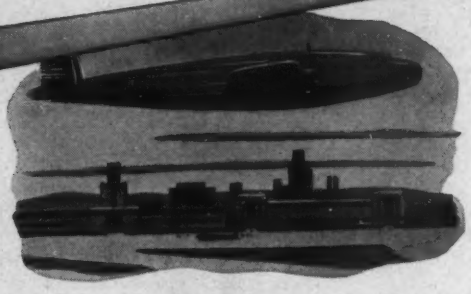

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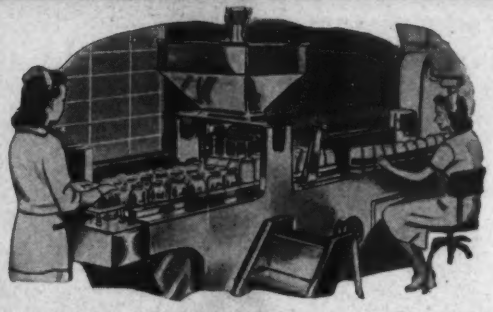

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Units of UCC do not make steel. They do make ferro-alloys used to purify and give special properties to steel. They also make non-ferrous alloys which, because of their exceptional resistance to wear, heat, and corrosion, are used as cutting tools, hard-facing welding rods, and for other purposes. UCC research and developments mean ever-new and improved alloys for industry . . . and ever-better products for you.

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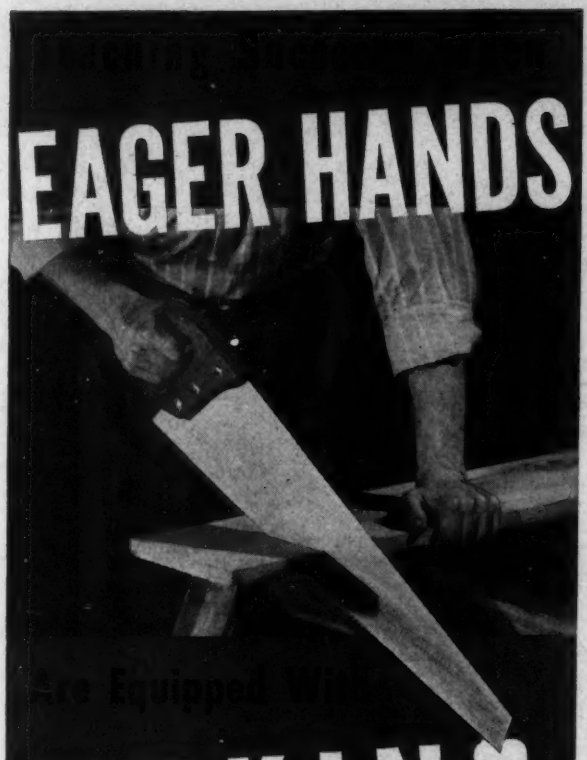

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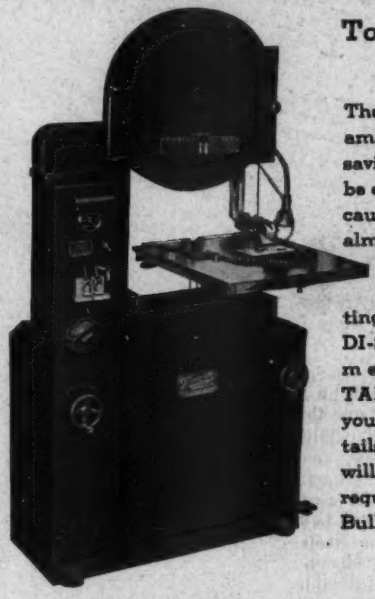

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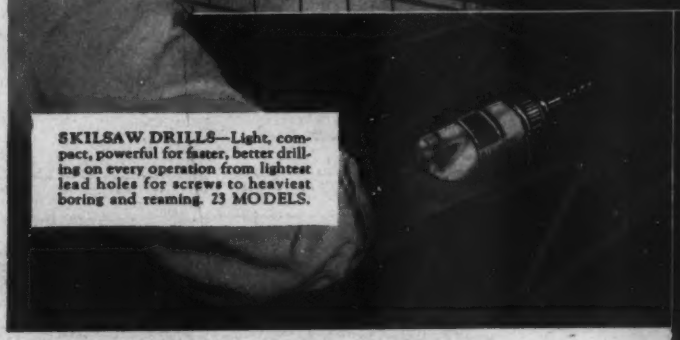

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SKILSAW TOOLS are more powerful, but since they're lighter and more compact they make learning easier for your classes . . . *and help them do perfect work sooner!* Ask your dealer to demonstrate SKILSAW TOOLS *today!*

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SKILSAW BELT SANDERS—For all "final-finishing" on flat surfaces of all materials. Light, perfectly balanced for smooth, even sanding and polishing. Belt widths: 2¼, 3 and 4½ inches. 4 MODELS.

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TRAIN THEM WITH WHAT THEY WILL USE

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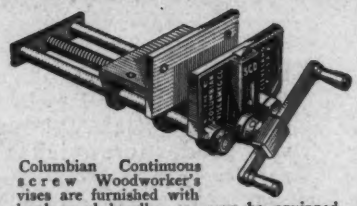
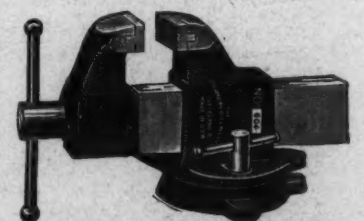


Columbian Continuous screw Woodworker's vises are furnished with hard wood handles—or may be equipped with ADJUSTABLE STEEL HANDLES, as above, to eliminate handle breakage, speed operation and provide extra leverage.



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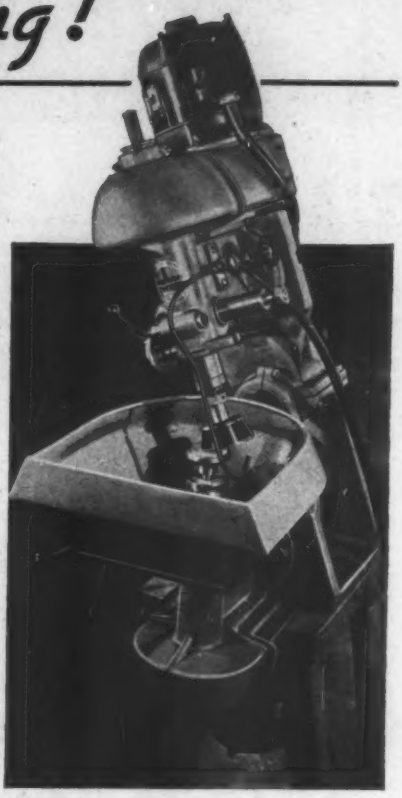
THE MORE VERSATILE THE MACHINE
the Better the Training!



● Because of their unusually broad range of speeds, Walker-Turner Machine Tools are being used on a wide variety of operations in war-time industry. A few are shown here.

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19123 Berckman Street, Plainfield, N. J.

(*Upper*) Using two Walker-Turner Drill Heads assembled in an automatic machine, William Mogey & Sons, manufacturers of precision optics, cut a rough grinding operation from 10 minutes to 30 seconds.

(*Lower left*) Cutting Plexiglas Bomber Noses at Rohm & Haas plant. Many war plants use these versatile Metal-Cutting Band Saws to relieve overworked heavier machines at congested spots.

(*Lower right*) Small diameter holes (up to ½"), a large area to be covered and a heavy, cumbersome jig, makes an ideal set-up for a Walker-Turner Radial Drill at the Lewyt Metal Products plant.

walker-turner
COMPANY, INC.
PLAINFIELD, N.J.
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MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

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The urgent demand for great quantities of war goods has led to a high degree of mechanization in industry. Wherever possible, machines are doing work formerly performed by hand labor . . . and are doing it better, faster, cheaper.

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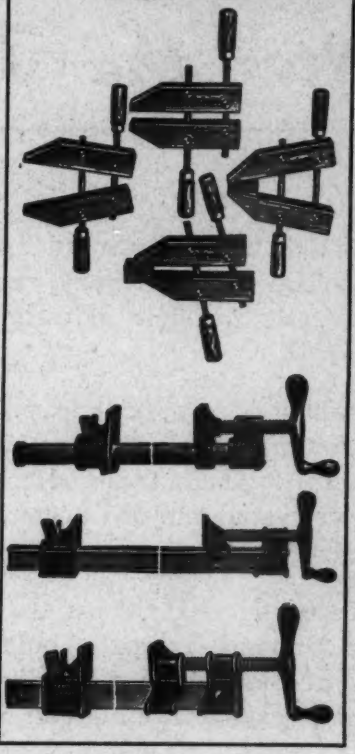

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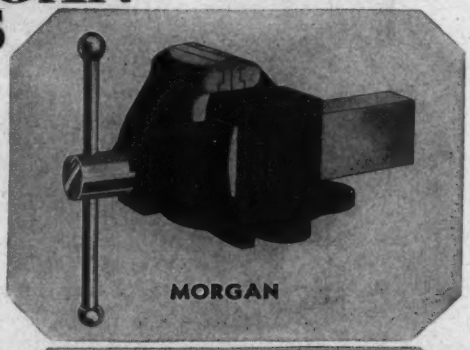
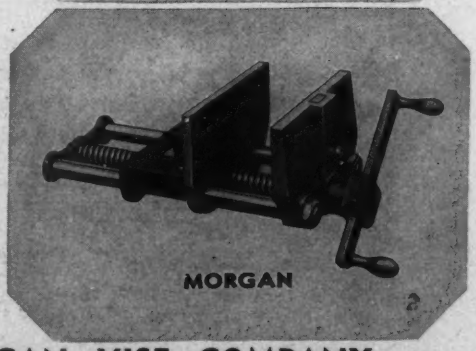
Boys like to work with MORGAN VISES





Morgan Vises represent more than a quarter of a century of experience in manufacturing vises. Made of quality materials and exacting workmanship, these vises are ready and able to give the utmost in industry and school shops for wartime service.

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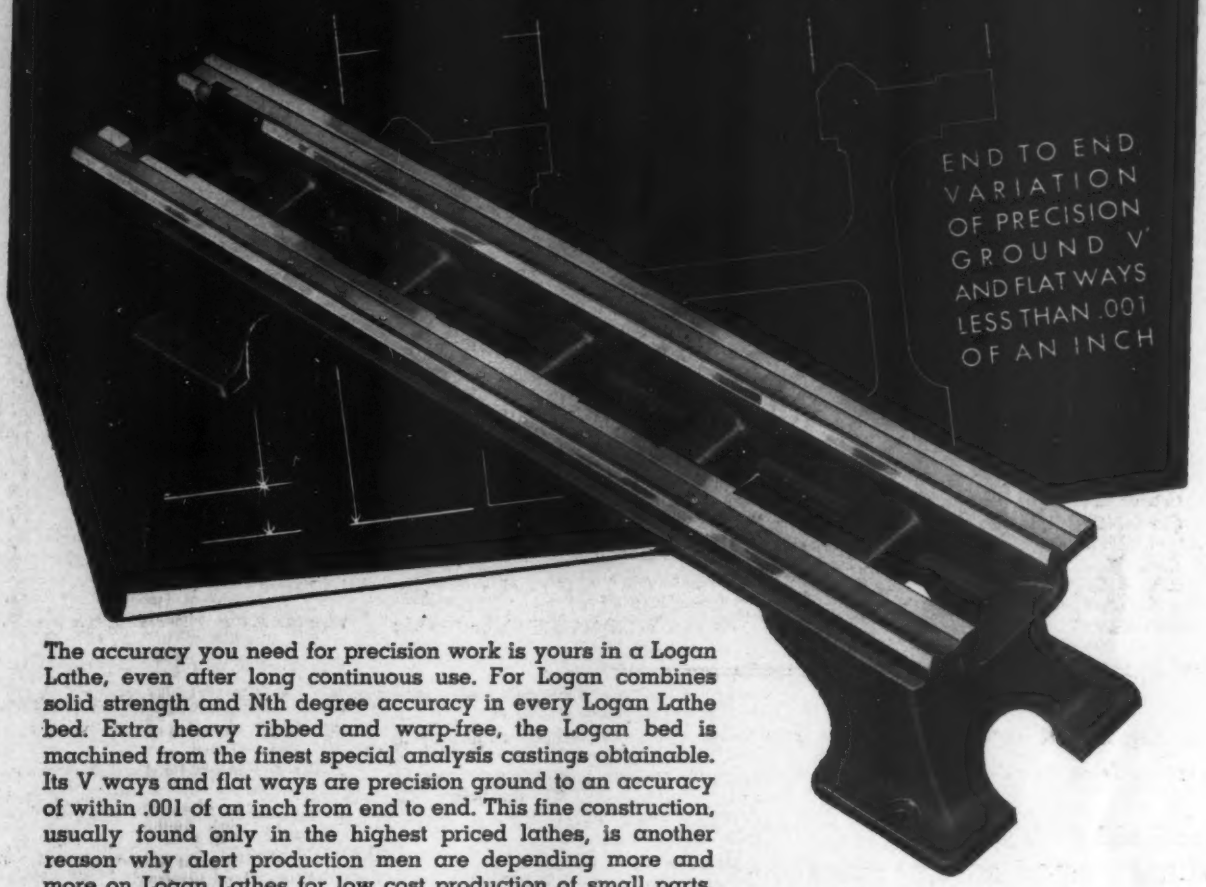

The accuracy you need for precision work is yours in a Logan Lathe, even after long continuous use. For Logan combines solid strength and Nth degree accuracy in every Logan Lathe bed. Extra heavy ribbed and warp-free, the Logan bed is machined from the finest special analysis castings obtainable. Its V ways and flat ways are precision ground to an accuracy of within .001 of an inch from end to end. This fine construction, usually found only in the highest priced lathes, is another reason why alert production men are depending more and more on Logan Lathes for low cost production of small parts.

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Logan ... A NAME TO REMEMBER WHEN YOU THINK OF LATHES

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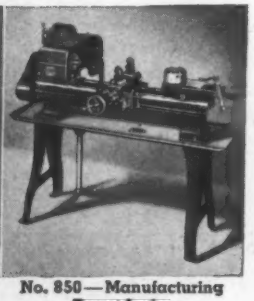

No. 850—Manufacturing Turret Lathe

How's your vocabulary on files?

BELOW, taken from the Nicholson book, "File Filosophy,"* is a dictionary of the more frequently used terms relating to files and filing. May it prove helpful to students in advancing their mechanical education, and to instructors as a review of file terminology.

REPRINTS of this page are available for school-shop and classroom bulletin boards.

**Have you enough copies of "File Filosophy" for your library and instructors' needs?*

Back. The convex side of Half Round, Cabinet and other files of similar cross-section.

Bastard Cut. File coarseness between "Coarse" and "Second Cut."

Bellied. Used to describe a file having a fulness in the middle.

Blank. A file in any process of manufacture before being cut.

Blunt. Used to describe a file with parallel edges and sides; *i. e.*, which preserves its sectional shape throughout from point to tang.

Coarse Cut. Coarsest of all cuts.

Curved Cut. File teeth which are made in curved contour across the file blank.

Cut. The character of a file's teeth with respect to *coarseness* (Coarse, Bastard, Second Cut, Smooth, Dead Smooth) or their *type* (single, double, rasp, curved, special).

Dead Smooth Cut. The finest of the standard cuts of regular files.

Double Cut. A file tooth arrangement formed by two series of cuts—the overcut, followed, at an angle, by the upcut.

Filing Block. A piece of hard, close-grained wood having grooves of varying sizes upon one or more of its sides. Used for holding small rods, pins, etc., in the jaws of the vise while being filed. Also a block of zinc, copper or other fairly soft metal as one of a pair of "protectors" placed between the vise jaws to prevent work becoming damaged while being held for filing.

Float. Sometimes used to refer to the coarser grades of single-cut files when cut for very soft metals (like lead) or for wood.

Hopped. A term used among file makers to represent a very wide skip between file teeth.

Overcut. The first series of teeth put on a double-cut file.

Point. The front end of a file.

Rasp Cut. A file tooth arrangement under which teeth are individually formed, one by one, by means of a narrow, punch-like chisel.

Re-cut. A worn-out file which has been recut and re-hardened after annealing ("softening") and grinding off the old teeth. (Similar to "regrooving" as applied to automobile tires.)

Safe Edge (or Side). Used to denote that a file has one or more of its edges or sides smooth or uncut, so that it may be presented to the work without injury to that portion or surface which does not require filing.

Second Cut. File coarseness between "Bastard" and "Smooth."

Section (or Cross-section). The end view of a file if cut off squarely at the greatest width and thickness from its tang.

Set. To blunt the sharp edges or corners of file blanks before and after the overcut is made, in order to prevent weakness and breakage of the teeth along such edges or corners when file is put to use.

Single Cut. A file tooth arrangement formed by a single series of cuts.

Smooth Cut. File coarseness between "Second Cut" and "Dead Smooth."

Superfine (or Super) Cut. The British equivalent of the file cut which American file manufacturers term "Dead Smooth."

Tang. The narrowed portion of a file which engages the handle.

Taper. Used to denote the shape of a file, as distinguished from the Blunt. Custom has also established it as a short name for the Three Square Handsaw File. Graded variations are Slim Taper, Extra Slim Taper and Double Extra Slim Taper.

Upcut. The series of teeth superimposed on the overcut, at an angle to it, on a double-cut file.

FILE NAMES

Aluminum "A." A special-cut file for work on aluminum stock or castings.

Auger Bit. A file with double ends (each with different cut) for sharpening auger bits.

Brass. A file for use on brass and similar soft metals.

Broach. Jewelers' steel-wire files of many gauges.

Cabinet (File or Rasp). Used by cabinetmakers and woodworkers.

Contact. A file for dressing "make-and-break" points of electrical circuits (also called Tungsten).

Corrugating. A file made for corrugating the edges of barbers' shears and other edged tools.

Crosscut. A file for sharpening cross-cut saws.

Die Cast. A file for use on aluminum or zinc castings.

Die Sinkers. Files, of various shapes, used by die makers.

Double Ender. A saw file cut from the points toward the middle—for filing from either end.

Foundry. A file used on castings formed from foundry molds.

Hand. A double-cut file with parallel edges and tapering thickness.

Handsaw. A triangular file (see Slim Taper) for sharpening handsaws.

Knife. A file whose cross-section resembles the blade of a knife—thick at one edge, thin or sharp at the other.

Lead Float. A single-cut file for use on lead, babbitt and other extra-soft metals.

Machine. Files used in filing machines.

Machinists'. Applied to various shapes of files, mostly double-cut, used in machine and repair shops.

Mill. A single-cut (tapered or blunt) file which acquired its name from its early use in filing mill or circular saws.

Needle. Files of many shapes, used by tool and die makers, and watch and clock makers.

Pillar. A parallel-edge file with rectangular cross-section of narrow width and extra thickness.

Pippin. A file with a cross-section resembling a pippin (apple) seed.

Pitsaw. A file used for sharpening pit or frame saws.

Plastic. Files, of various types, used in flash removal and other finishing work on molded plastic products.

Rifflers. Fine-point and vari-shaped files used by die sinkers and silversmiths.

Screw Head. A file for clearing out the slots in the heads of screws.

Shear Tooth. A coarse, long-angle, single-cut file.

Slim Taper. Triangular file, slenderer than the regular Taper, used mainly for handsaw sharpening. Also Extra Slim Taper and Double Extra Slim Taper.

Stainless Steel. A special-cut file for use on stainless and other extra-tough steels.

Swiss Pattern. A large series of files of various shapes and a range of cuts of their own, designed principally for precision work in the jewelry, die-making, silversmith, clock-making, watch-making and other industries.

Taper. Used to denote the shape of a file as distinct from Blunt. Custom has also established it as a short name for the triangular Handsaw File.

Three Square. A file whose cross-section is triangular. Usually applied when such file is double-cut.

Warding. A file named after its original use—filing ward notches on keys and locks.

NICHOLSON FILE CO., 47 ACORN ST., PROVIDENCE 1, R. I., U. S. A.

(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON FILES
FOR EVERY PURPOSE
NICHOLSON
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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

VOL. 32 DECEMBER, 1943 Number 10

Chicago and the A.V.A. Convention

Have you made arrangements to attend the American Vocational Association Convention which will be held in Chicago on December 15, 16, and 17?

Visitors may be sure that Dr. William H. Johnson and his co-workers will do everything possible to make this convention a real success.

Those who are interested in industrial arts and vocational education have many questions to discuss. Some of the problems that confront these men can be solved and settled at the meetings to be held; others can merely be stated and discussed. Only time will help in their final solution.

Readers who can arrange to attend this annual assembly should not fail to do so. And since the individual gets out of a convention about as much as he puts into it, come prepared to enter into the discussions.

The Annual Index

Again we have come to the end of another year and also of another volume of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

As a matter of conserving paper, which in these days must be taken very seriously, the index for Volume 32 will be printed separately and not made part of the December issue.

A copy of the title page and index will be sent gratis to those who address a postal card with their request to the magazine at 540 North Milwaukee St., Milwaukee 1, Wis.

This Month's Cover

The original of the picture on this month's cover was taken in one of the many industrial-arts laboratories that have been established in Chicago, Ill.

Photograph, courtesy of Dr. Louis Newkirk, director, bureau of industrial arts, Chicago, Ill.

CONTENTS

Crafts in the School and Home, *William H. Johnson* and *Louis V. Newkirk* 399
Industrial-Arts Teacher Traits, *Murray Lincoln Miller* 401
A New Industrial Arts for a New Day, *Arthur B. Mays* 402
In-Plant Training, *Robert W. Tarbell* 404
Teacher Training After the War, *William T. Bawden* 407
Preinduction Training in the Schools, *Thomas Diamond* 408
Teaching, *Leonard E. Schmidt* 409
Instructor Training Through Observation and Application, *Homer C. Rose* and *Roy E. Howard* 410
Professional Development of Industrial-Arts Teachers, *Charles M. Herlihy* 414
Training Replacements for Industrial-Arts Teachers, *Gordon O. Wilber* 416
Shipyard Develops New Training Idea, *Sam LeCount* 418
Editorials 419
The General Shop After the War, *R. T. Craigo* 420
Skidding Season Here 421
The Carpenter 421

Problems and Projects

Reading a 36-Digit Number, *Michael W. Zehel* 421
Reading Nomographs or Alignment Charts, *Gifford N. Mast* 421
Lathe Cutter Bits From the Scrap Heap, *J. Henry Schroeder* 422
P. T. Boat or Mosquito Boat, *James McGregor* 423
Sheet-Metal Jig for Aircraft Riveting, *Harry Kerwin* 424
Jumping Jack, *Harold O. Akeson* 424
Ash Tray and Pipe Rack, *R. E. Murray* 425
Glider Ground Trainers, *Lynn A. Emerson* 427
Repulsion Vane-Type Meter, *A. G. Beleson* 428
Making a Sloyd Knife Out of a Discarded Plane Iron, *Louis F. Barocci* 428
Airplane Sheet-Metal Shop Practice, *M. D. Caffin* 429
Techniques in Using the Jig Saw, *John McInnes* 430
Orthographic Projection — Identification of Lines and Tools, *Harry F. Mergler* 430
Whittling-Jackknife Technique, *W. Ben. Hunt* 431
Molding Plastics in High School, *Dale Peterson* 431
Creative Design, *Richard E. Bailey* 433
Design for the Teacher of Industrial Arts, *Burl N. Osburn* 434
Modern Book Ends, *R. B. Newhauser* 435
The Jeweler's Vise, *William A. DeVette* 436
Orthographic Projection — Recognition of Views, *Harry F. Mergler* 438
A Lacquer Brush Holder, *Frank C. Campbell* 438
Techniques in Using Drill Press, *John McInnes* 438

Personal News 22A
Association News 24A
News Notes 26A
New Publications 30A
Shop Equipment News 32A

Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

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Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

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No. 49 of a Series

There's sabotage going on in many school shops. Every day carelessness and neglect damage valuable, much-needed equipment just as effectively as if it had been tampered with by enemy agents. We admit that this evil cannot be eliminated, that's why we build our machines extra strong, but it can be minimized.

The J-47 Sander, for example, is operated at times with discs and belts that are badly worn. This is a harmful practice, as it places a considerable amount of additional strain on the motor and operating parts. Modern adhesives have made the task of changing abrasives so easy that there should be no reason for neglecting it. Use the proper type abrasive; garnet for wood only, electric furnace products for metal and wood.

Belts should be installed so that the stock will press down on the lap joint rather than raise it. When adjusting the tracking device take care that the belt is not tightened too much.

Yates-American machines are built to exceedingly high standards of quality. Give them the care they deserve.

YATES-AMERICAN MACHINE COMPANY • BELOIT, WISCONSIN

SHORT TALKS ON WOOD

OSAGE ORANGE (*Toxylon pomiferum*)

This tree is known by a number of common names such as mock orange, hedge apple and bois d'arc. It was used extensively for bows and arrows by the Osage and other Indians. The wood is heavy, hard, strong, close-grained and very flexible. Takes a fine polish. Difficult to work. Exceedingly durable in contact with soil. Bright orange in color but turns brown on weathering.

One of the best trees for fence post use. Large amounts of this wood still go into the manufacture of archery equipment. Also used for paving blocks, clubs, flooring and novelties. Bark is sometimes employed in tanning leather.

Is native to the Gulf states but is now cultivated over the entire country. Prefers deep, moist, well-drained soil. Is commonly planted as a windbreak and a hedge fence. The litter of its fallen fruit makes it objectionable for ornamental planting.

Usually attains a height from 20 to 40 feet and a diameter from 4 to 12 inches. The trunk is short, and its stout branches produce a low, symmetrical, rounded crown. Twigs are armed with sharp thorns.

The bark is gray and deeply divided into irregular, broad, rounded ridges. The leaves are simple, alternate, smooth-edged, from 3 to 5 inches long and 2 to 3 inches wide. Turn to bright yellow in autumn. Bears a large, warty, yellowish-green fruit which is somewhat like an orange in appearance.

YATES-AMERICAN

Crafts in the School and Home

WILLIAM H. JOHNSON* and LOUIS V. NEWKIRK**

Crafts are accepted as a wholesome means of employing leisure time for children and adults and offer many opportunities for learning to use tools and materials. Crafts have become a fundamental part of education for the young and one of the stabilizing influences of adult life.

The craftwork in the elementary and high school should provide broad opportunities for the boys and girls to develop their ability and interest in the crafts. Craftwork often leads to valuable hobbies and in some instances leads to a vocation. Woodcraft, needlecraft, ceramics, leathercraft, metalcraft, and plastics have proved to be of great interest and value in the Chicago public schools.

The Chicago schools provide the children with broad opportunities in the crafts through regular courses and through the craft clubs. Most Chicago elementary schools have craft clubs. The greatest number of clubs are found in the sixth, seventh and eighth grades. Some elementary schools have as many as eight craft clubs. The home mechanics laboratory is a regular practical-arts course for grades 6, 7, and 8 and gives many additional opportunities for craftwork and encourages the development of the home workshop for those boys and girls who show ability and interest in one or more of the crafts.

Papercraft has many possibilities for decoration and adornment

Nature intended that man should live by the use of his hands. Civilization dictates that many men and women must live by the use of their brains. In many instances this condition sets up conflicts within the individual. Psychologist and psychiatrist frequently prescribe that office workers and professional people devote some of their time to craftwork in order to relieve nervous tension. Many adults can provide workrooms in their own homes; but they do need the help of someone to develop the interest and provide the basic instruction. Again the schools, churches, and community organizations may come to the aid of their groups. Frequently, the more highly skilled the craft is the better the adult likes it. Among the craft activities popular with adults are silverwork, lapidary work, wood carving, and ceramics. In many instances individuals attain a high degree of skill that surpasses even that of the professional. Working in these highly skilled crafts the individual may spend years or even a lifetime in one field of endeavor. Those who like to make things naturally wish to gain the approval and admiration of their friends. Because of their keen interest they strive for and obtain a high degree of skill; their interest seems to be determined by whatever the better shops are showing and may run the entire gamut of craft activities.

Medical authorities have long recognized the value of occupational therapy as an important aspect of the patient's mental

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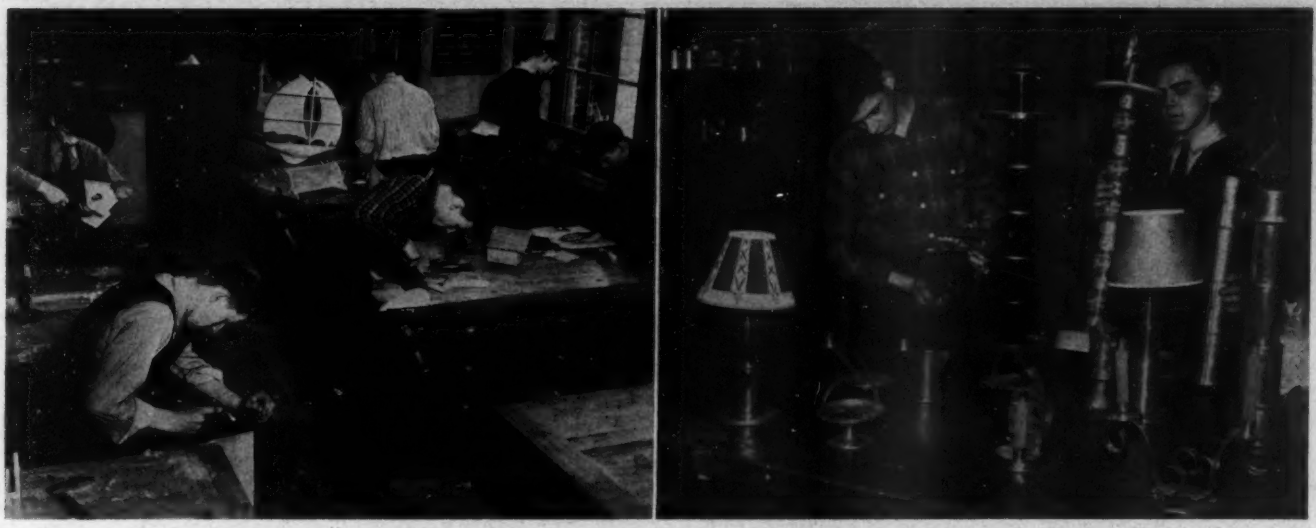
Plastics has many fascinating possibilities for the home craftsman. Leather tooling and lacing is an interesting and fascinating type of craftwork



Woodcraft offers many opportunities for project development. Tin-can craft has many possibilities

and physical recovery. The community, through the auspices of such organizations as the Red Cross, may provide hospitals with competent instructors and adequate materials for carrying on a craft program. The projects should be of such a nature that they may be made in bed or in workrooms requiring a limited amount of equipment. Another consideration that must be kept in mind when working with these patients is the fact that in most instances their chief interest is in their relatives and friends at home. The craft projects therefore should be of a personal nature that can be worn or used by some loved one at home. This group responds well to textiles, leather, plastics, wood, and metalwork.

Leather lends itself to tooling and the finished project has a professional appearance. Purses, billfolds, key cases, and moccasins are popular projects. Plastics is a craft material that makes an instant appeal. Lapel pins, bracelets, desk sets, and necklaces are simply and easily made from plastics. Wood carving is good for those who have patience and persistence. It frequently happens that a special ability developed during convalescence may ultimately become a means of livelihood.

It has long been recognized that one of the prime stabilizing and unifying influences of the Scandinavian countries has been their universal acceptance of craftwork as a part of daily living. Perhaps with a broader crafts program designed for young and old, a healthier mental attitude could be obtained, and we would all gain a new admiration for the ability of our fellow man.

Selected Bibliography

A selected bibliography has been carefully compiled according to craft groups. The books listed are, for the most part, on

Knotting and braiding can be used to make many beautiful and useful projects. Christmas toys offer wide craft possibilities and bring much pleasure to boys and girls

Egyptian card loom has many possibilities for weaving belts and ties

"how-to-do it" and touch only lightly on the technical aspects of the subject. The books listed are, with one exception, all rather recent publications.

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PAPERCRAFT

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Sources of Craft Materials

In spite of present conditions many craft materials are still available. The resourceful teacher can find many substitute materials for those that are not available. The following list is by no means complete but is only a suggestion of the possible sources. Many communities have excellent local sources of craft materials and frequently the individual has to seek no farther than his own back yard. However, some tools and other materials must be purchased and may be obtained from the several companies listed below.

GENERAL

Broadhead-Garrett Company, Cleveland, Ohio.

Burgess Battery Company, 180 North Wabash Ave., Chicago.

Joseph Dixon Company, Newark, N. J.

Metal Crafts Supply Company, 10 Thomas Street, Providence, R. I.

Lusky, White & Coolidge, 216 W. Monroe Street, Chicago.

American Handicrafts Company, 193 Williams Street, N. Y.

SPECIFIC

Plastics

Rohm & Haas, Washington Square, Philadelphia, Pa.

Wood carving provides many opportunities for creative expression

Small Electric Tools

Chicago Wheel & Manufacturing Company, 1101 Monroe St., Chicago.

Sterling Silver

Thomas J. Dee and Company, 1900 W. Kinzie Street, Chicago.

Ceramic Products

American Art Clay Company, 4717 West Sixteenth Street, Indianapolis, Ind.

Leather

Osborn Brothers, 223 Jackson Boulevard, Chicago.

Yarn Loops

Colonial Yarn Links Company, Charlotte, N. C.

Unusual Woods and Fine Veneers

Albert Constantine & Sons, 797 East 135th Street, New York City.

INDUSTRIAL-ARTS TEACHER TRAITS

MURRAY LINCOLN MILLER
State Teachers College Laboratory School
Indiana, Pa.

Some Traits of Good Teachers

Stimulates and maintains interest.
Has an easy, conversational manner.
Provides for individual differences.
Develops pupil self-control and self-direction.
Is enthusiastic about helping pupils learn.
Attends carefully to pupils' questions.
Is pleasant and shows appreciation.
Teaches social and occupational implications.
Has a good sense of humor.
Makes thinking an outcome of doing.
Is patient under stress.
Teaches analysis, planning, and accuracy.
Uses well-written instructional aids.
Develops attitudes, habits, and abilities.
Gives oral and written safety instruction.
Uses many illustrative materials.
Conducts brief, skillful demonstrations.
Has functional knowledge.
Makes use of community resources.
Uses well-established examination and evaluation procedures.

Some Traits of Poor Teachers

Is lazy about planning in advance.
Has poor discipline.
Is sarcastic.
Is incapable of stimulating interest.
Insists on inflexible requirements.
Appraises pupils by opinion alone.
Is very positive and autocratic.
Loafs on the job.
Makes few helpful suggestions.
Nags the pupils.
Makes little effort to develop social responsibility.
Shows favoritism.
Is too familiar with pupils.
Does not maintain democratic relationships.
Bluffs and will not admit mistakes.
Is irresponsible.
Does not cooperate.
Is lax about handling accounts.
Is a troublemaker.
Has the pupil bring work to the teacher for inspection instead of going to the pupil.

A New Industrial Arts for a New Day

ARTHUR B. MAYS*

Since 1880 there has never been a year when the manual-training movement has not shown definite growth in the schools of the United States. At first it found its way into the large cities where it invariably attracted much attention, both from educators and laymen. Then with accelerated speed it spread to the larger towns, then to the smaller towns and finally to many rural communities. It is still growing and every factor in the present situation suggests a very great expansion in the postwar era. Throughout the 63 years of the history of growth of what we now know as industrial arts there have been many changes in the character of the courses and the range of experiences provided. Even the very psychological basis of the work has fundamentally changed, but singularly enough, the general aims of Dr. Woodward were little different from those of Robert Selvidge, Charles Bennett, and the younger thinkers of the field of the present day. Industrial arts today is concerned with the intellectual and aesthetic culture of youth, with the release and development of creative powers and with adjustment to the life of an industrial civilization. These were the underlying concepts of the pioneers.

There have been many changes in types of equipment, courses, methods of teaching, and administrative practices through the years, but intellectual culture, release and cultivation of creative powers and economic and social adjustment are still of paramount importance. As we have tried to realize these purposes in a constantly changing cultural and economic environment the field of industrial arts has been greatly enlarged and enriched. Today it is firmly established and universally recognized as an essential feature of modern democratic education. Today industrial arts connects with the kindergarten at the bottom of the educational ladder and joins hands at the upper levels with the trade school and the university. We still think of it as a vital aspect of general education having very great basic vocational values. As the earlier and unfortunate antagonisms between industrial arts and vocational-industrial education disappear, it becomes increasingly recognized as an important foundation for the most effective vocational education, but retains its historic significance as a necessary phase of general education in an industrial age.

Industrial Arts in the Years to Come

But what of the future? To those of us whose business it is to try to interpret to student teachers the meanings of the past and present and to anticipate the future there are many discouragements as we try to see into the coming years when the greatest conflict of all the ages is finished. What will be the character of our world after the storm and what will be the educational needs of the youth of the new day? There has never been a time when the work of the prophet was more difficult. The only certainty before us is that a new and different world awaits us. All anyone can do is to bring to bear the best knowledge he has of the past and the present, and make the most reasonable surmise possible as to the years immediately ahead.

One factor in the postwar situation which seems certain is an increasing interest in secondary education and an ever growing demand for all forms of industrial education. There are clear indications of what some have called "a new industrial revolution." Of course, it will not be a *new* industrial revolution but only a greatly intensified stage of the revolution through which we have been passing in this country since the middle of the nineteenth century. As in World War I, so in World War II will millions of persons be convinced of the necessity for mechanical and technical training as the prerequisite of occupational success. An expansion of industry is inevitable, and training is increasingly becoming a necessity for success in industry. Furthermore, industry is destined to play an ever greater role in the social, economic, and political life of the nation, and that will mean that all intelligent citizens must know much concerning the problems, processes, and products of industry and their significance in the welfare of the nation. As the representative of industry in the general school curriculum, industrial arts will, therefore, of necessity play an increasingly important part in the program of general education.

As vocational-industrial education expands at the upper levels of the secondary school and in the posthigh school courses of junior-college grade, industrial arts will come increasingly to be regarded as an important aspect of the educational foundation of those entering trade and technical training courses. This will doubtless result in a great expansion of offerings in the junior high school years. To meet the requirements of the new industrial era, many more teachers of industrial arts will have to be trained and they will have to be better trained than at present. Their training will have to be both more extensive in the range of manual and technical skills and knowledge, and more intensive in character.

New materials and new techniques are already moving into places of major emphasis in shop courses and this trend will be ever more marked in the years following the close of the war. Because of the amazing developments in aviation, internal-combustion engines, metal alloys, plastics, electronics, and machine design, industrial arts will not only be under the necessity of developing courses involving new materials and techniques, but it will have to establish much closer relationships with the school courses in physics and chemistry. Indeed, there are present now areas in the curriculum where it is difficult to determine where physics leaves off and industrial arts begins. The industrial-arts teacher of the years immediately ahead must be thoroughly trained in physics, chemistry, and mathematics if the new demands of the industrial age are to be met by the schools. Likewise, there will be a growing pressure upon high school industrial-arts teachers to have trade experience as part of their preparation; and constant contact with industry will be imperative. One of the chief characteristics of modern industry is rapid change, hence frequent short employment experiences in industry to learn new processes and organizational procedures will be needed by progressive shop teachers as never before. This will mean not less college training but more vacation periods spent in industrial employment by industrial-arts teachers. Incidentally it should be pointed out here that a college-trained shop teacher can usually learn more during industrial employment in three months than most untrained men will learn in as many years. They have more knowledge and other intellectual equipment with which to learn.

What the Future Requires of Industrial Arts

In view of these considerations there are certain qualities which industrial arts of the New Day must possess. The following characteristics seem to the writer to be those required of a new industrial arts for the new day which is already dawning.

Industrial arts and skill: There must be more emphasis upon skill, both in manual and machine processes taught. Some extremists in the progressive education movement have discounted the value of skill and much of the educative and prevocational values of industrial arts has thereby been lost. There must be a return to Dr. Woodward's emphasis upon skill and knowledge of tools. A teacher who possesses a high quality of mechanical skill can make the acquirement of skill an attractive aim of his pupils. Few accomplishments give more genuine satisfaction than the con-

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scious possession of manual skill. It easily becomes a factor in self-confidence and self-respect without which the most desirable moral qualities are difficult of realization. Where little or no emphasis is placed upon accurate, skillful performance of tool and machine processes some of the most important educative values of industrial arts are lost. There are clear indications in the present situation that higher standards of achievement will be required by the new day into which we are moving, and one of the best places in the whole scheme of education to develop high standards of workmanship is the school shop.

Industrial arts and science: More scientific and technical knowledge must be imparted in connection with the shop instruction. Almost every element in the present industrial situation indicates the necessity for this development. The emphasis upon technical knowledge in the various branches of the armed services and in many of the war industries during the present war has brought to the popular mind as never before the importance of technical training. The amazing advances in the applications of scientific knowledge to the daily work of the world and the resultant developments in production processes make an interest in and an understanding of the technology of industrial work an important phase of shop instruction. There is every indication that a growing need for technical knowledge, not only for vocational ends, but for the purpose of being intelligent about modern life, will exist in the postwar era.

Industrial arts and industrial progress: The growing complexity of industrial processes and of economic and vocational life make urgent an increasing stress upon the development of the *habit of analytical constructive thinking*. This is largely a matter of method of teaching and instructional skill. It involves the whole range of educational techniques concerned with self-discipline, thoroughness, and desire for perfection. Only teachers who themselves possess this habit can successfully aid pupils to develop it. As the standards of achievement continue to rise, intelligent procedure becomes a necessary requirement for success at all occupational levels. Intelligence in work is chiefly a matter of habitual analytical thinking about one's work. One of the chief aims of industrial teachers should be the development of the power and habit of thinking through one's tasks before beginning work and of trying to understand thoroughly every step one takes in his work. The industrial-arts shop and drafting room are ideal places for the growth of this habit and, in looking toward postwar developments, it seems clear that renewed emphasis on methods to accomplish such an end should now be made. This outcome of shop and drawing instruction should be always uppermost in the teacher's thoughts.

Industrial-arts offerings: More attention must be given in course offerings to new materials, new procedures, and new applications of the sciences to the daily work of the world. This will mean constant study by shop teachers and frequent contacts with new industries. Now is the time for industrial-arts teachers to familiarize themselves with the new materials and processes which can appropriately be used for educational purposes. New materials should not be added unless they are appropriate to the aims and methods of school-shop teaching. Mere newness will not justify their inclusion in courses of study, but if they are meeting important needs of a new day, they should be carefully studied as possible additions to the materials found valuable for educational purposes.

Industrial-arts shops must portray industry: Shop equipment, arrangement, and organization must be a more accurate representation of modern industry. Pupils must be made aware of the similarities of their procedures, tools, machines, and class organization to the procedures of modern factories and industrial practices. As the representative of the industrial element of the environment, industrial arts should give as accurate account of modern industry as is compatible with the limitations of school instruction. Much progress has been made in recent years in factory planning and management and this progress should be reflected in the arrangement and procedures of the industrial-arts shops. There are, of course, limitations to the extent to which the school shop can reflect the developments of modern factory planning. However, the shop teacher can profitably give far more attention to this matter than is usually given, thereby greatly enhancing the educative value of his courses. This is a feature of industrial-arts instruction and administration which probably will be of increasing importance after the war.

Industrial arts requires more school time: Industrial arts must be assigned a larger place in the time schedules of the school. Much more time per week must be devoted to experiences in shop and drafting room than is now provided in most schools. Much improvement in recent years has occurred in city schools in this matter, but in the nation as a whole it is still one of the most serious obstacles to effective instruction. For the most part, the inadequacy of time allotments to shop and drawing courses is due to lack of realization of the educative value of the work on the part of school administrators. It is impossible to obtain the full values from industrial-arts courses unless adequate time is allowed for classwork. Teachers should assume an aggressive attitude on this matter and try by every legitimate means to convince school authorities of the necessity for sufficient time to realize the aims of the shop and drawing courses.

Industrial arts more generally available: Industrial arts must be made available to hundreds of thousands of children and youth who are now denied the opportunity for such experiences. This will mean (1) a vigorous campaign to extend offerings to small schools in villages and rural areas which have no offerings at the present time, and (2) greatly enlarged departments in many schools now offering one or two courses. There are yet far too many schools in the United States which offer no industrial-arts experiences to their pupils, and too many schools which provide extremely limited offerings. It is probable that school authorities have never been as interested as now in this phase of education and now is the time for a vigorous campaign to extend throughout the nation this type of schoolwork.

Industrial arts and vocational-industrial education: A closer relationship between the offerings of industrial-arts courses and those of vocational-industrial education is needed. This will be to the advantage of both divisions of industrial education. In both its technical and mechanical content, industrial arts is closer to vocational-industrial education than to any other phase of schoolwork. The two phases of industrial education are frequently administered by the same special school official. There is every reason to plan courses so that the industrial-arts experiences will prepare for and lead toward the vocational courses. They are not only valuable as foundation for more specialized and intensive shop experiences at the vocational-education level but they may, in some cases, make unnecessary the elementary work in the vocational courses. For boys who are definitely headed for the trades, the industrial-arts courses can be most helpful in aiding the choice of trade. These values can be fully exploited without diminishing in any degree the general-education values of industrial arts. Industrial arts is designed to prepare boys and girls to live intelligently and effectively in an industrial world and vocational-industrial education is designed to enable them to make a living in such a world.

Industrial arts in the lower grades: Greater attention should be given to forms of industrial arts appropriate for the elementary grades as a required feature of the elementary education of every child. The exercise of the creative powers possessed by all normal human beings should be encouraged as early as possible. All human progress throughout history has been the result of this innate potentiality. It is one of the most significant qualities possessed by man and the whole world suffers and is held back when it is left undeveloped in any single generation. There are a few areas in the whole program of organized education where creative ability can be as appropriately and effectively developed as in industrial arts. Furthermore, the general development of personality and the powers of accurate thinking and expression of ideas in children is promoted through industrial-arts activities as in few other life experiences of early childhood. Every possible effort should be made in the years immediately ahead to enlarge and

enrich the offerings in elementary industrial arts. Outside the larger cities this phase of industrial arts has been sadly neglected. This gap in the program between the work of the kindergarten and first two or three grades, and the junior high school shops should be more universally filled in the schools.

Recruiting industrial-arts teachers: Finally, more outstanding boys and young men must be urged to prepare for industrial-arts teaching as a lifework. Few vocations offer a more promising career, and shop teachers should use every legitimate means to recruit for their profession the brightest and best of their pupils. The future of industrial arts depends upon the caliber of those engaged in it professionally and upon the leadership developed among them. Too long industrial-arts teachers have encouraged their brightest and ablest pupils to enter engineering or some other technical profession. The opportunities in industrial education are growing by the year and the future is most promising. Every effort should be made to direct brilliant boys toward a life of social service in the school shops and drafting rooms. The progress of all industrial education is at stake in this matter.

It is high time that all who have devoted their lives to this important field of education should be concerned and active in its preparation for the new demands which will soon be upon it. There has never been a time in the history of education when there was more general interest in all phases of education. The educational administrator is looking for help in his efforts to meet the industrial-education needs of the new day, and he has the right to look to us for guidance and leadership. The obligation is heavy upon each of us in our several communities to study our work as never before; to try with all our powers to understand the trends of contemporaneous life as they relate to our field and to formulate programs which will give to industrial arts its rightful place in the education of the new day that is upon us.

In-Plant Training

ROBERT W. TARBELL*

Wars put men to the test. We jog along at a normal rate in times of peace, content with our customs, accepting new ideas with a degree of nonchalance, a bit heedless of possibilities about us. But when necessity demands action, the response is immediate. Nations that desire peace and are willing to compromise many things to have it will draw the sword in earnest when attacked. New inventions come in abundance, bravery is manifest everywhere, sacrifices are made with courage.

In World War II the need for skilled workmen is keenly felt. It is too long a story to explain all the steps that lead to this condition, but three facts will show the main features: (1) greatly reduced available skill in the country because of few new trainees during ten years of depression, (2) warfare has rapidly become mechanized, (3) the tremendously increased demand for equipment.

In such a crisis acute shortages of man power become evident. In the great desire to make deliveries on time manufacturers hire green help. Breakages result, equipment is out of order, material is wasted, production is slackened. The demand arises for some kind of training or upgrading to overcome this difficulty. It should be said at this point that manufacturers have had systems of training within industry for many years. Apprenticeship is as old as civilization. It has served the purpose admirably. In recent years this country has seen the advent of the corporation school, the vestibule school, and the cooperative school. For our present purposes we will pass over these.

Definition. In-plant training enters the picture. There may be nothing new under the sun but there can be adaptations. This new type of instruction is definable in terms of old practices. As pointed out a moment ago, there have been several kinds of training programs set up within the plant area, all of them having one objective — to improve the skill and understanding of the employee. In this present crisis emergency programs have been inaugurated to raise the level of skill as rapidly as possible. Schools extended their hours, all-night classes became the practice, curriculums were revised to teach the essentials more quickly. And still the demand for trained people increased. Industry was beset with a shortage of man power and hired green help. But an unskilled workman cannot operate complicated machinery in this modern day of speed without mishaps. Tool breakage was frequent. Production was slower. The quality was mediocre. In such a dilemma employers looked for a remedy. If these unskilled workmen could be trained on the job, the situation would be improved. But supervision was already stretched to the breaking point. Foremen were covering increased territory and had little time to teach new help. At this point the vocational schools of the country stepped in. Now we can define in-plant training as used in this discussion. It is training given on the plant premises by a special instructor from a vocational school to upgrade the ability of employees. The material worked on and the activities performed may be in the line of production or the training may be confined to an area where a series of practice exercises are used to bring the trainee up to the level of production proficiency. The new feature about this is the fact that the school teacher has stepped into the plant to train employees on the job.

Operation. Let us examine, briefly, the operation of this program. We are all thinking of in-plant classes just now as being a part of the plan of emergency war training. As such they are sponsored by the Federal Government. The type of instruction to be given, the trainees to be selected, length of training, and other details must be acceptable as in all classes sponsored by the government. Arrangements are worked out with plant management to place an instructor on the job.

An illustration or two will serve the purpose. A plant has an assembly line where employees need instruction in assembling small parts. An instructor who can devote his time to new employees can rather quickly instruct people in correct, efficient methods. Again an instructor in a machine shop will teach the correct tool processes, thus bringing employees up to the level of acceptable performance as operators. It may be loading shells or heat-treating castings or soldering tin containers. Throughout the whole range of jobs incident to the production of the goods of war people can be taught at work to produce more and better articles. This is in-plant training.

Problems

Programs and problems go hand in hand. Where problems take the form of difficulties they must be solved before accomplishment can take place. Innovations imply a revision of thinking and procedure. People must work together under new conditions, old practices must give way to new, pet notions may be ordered to the scrap pile. The world moves on. In times of emergency adaptations

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must be made quickly. Let us look at the picture and list a few problems. An instructor is placed in the plant. Skilled in his field though he may be, the fact that he is coming into a plant to teach people how to do their work is an implication that someone already there has failed to do the job. The first step, therefore, is to launch the program with no friction. Traditional attitudes may need to be changed. Foremen may be reluctant to see the advantages of the program. Employees sometimes feel that this is just another speed-up plan and resent it.

Instructor or foreman. Shall the instructor step in and simply take over a department, becoming teacher and foreman, handling administrative detail and being responsible for production? It would be easy to follow such a pattern. Or shall there be a clearly defined idea of his function? By the terms of the federal program he is to be an instructor. It is necessary for the school, therefore, to explain to the employer that this is purely an instructional job. What that may resolve itself into as the classwork progresses depends on how well the job is analyzed. When an instructor teaches a person the correct way to perform a given operation, that employee is gaining skill. After he has acquired the proper skill, further instruction is unnecessary. Any added attention on the part of the instructor is administrative in nature and comes under the head of supervision. Likewise, shifting workers from place to place, discussing wages, hours, conditions, and other problems, properly belong with the foreman.

Using shop facilities. It may require considerable ingenuity and adaptability to make good use of shop facilities. The instructor has been accustomed to his school shop where production problems are secondary. The in-plant training teacher finds himself in a larger place, with a variety of machines, with production staring the management in the face, with employees anxious to maintain their rates, and with the technical training harder to put over.

Co-ordination with industry. The instructor finds other forces in operation in the plant. He must co-ordinate his work with the flow of production. He must get along with the personnel about him. There are traditions in the plant which must be observed. Everyone is under a strain with the war effort, and temperaments may wear thin at times. The success or failure of the whole program may depend on the relationships maintained in this area.

Class administration. And then there are problems that pertain more specifically to class administration. Class organization cannot usually be as concise and well arranged as in a school shop. The students are scattered about. There is the noise of a big place, coupled with the bustle of production. Employees come and go. The shifts change. Absenteeism interferes. Labor turnover alone makes the program difficult. All these matters are challenging and call for resourceful treatment.

Benefits

Every movement has its by-products. Out of the problems just discussed and the extra effort put forth come benefits to the school. The chief objective of in-plant training, of course, is the immediate upgrading of employees to the end that the production of war goods will be hastened. It may be said here, parenthetically, that no criticism should arise on the matter of increasing the production of the goods of war. Civilization is hanging in the balance, and everyone should welcome a chance to improve the common defense. We assume, then, that an increased output of war goods is a legitimate objective and a benefit. Following are some specific benefits.

Keeping in touch with industry. Vocational teachers appreciate the value of keeping up to date. No man can remain cloistered in a school shop year after year without slipping behind in his understanding of the world of work. It becomes the universal experience of teachers who are assigned to an in-plant program that they find new equipment, new methods of procedure, new materials, new production requirements, and new relationships. All these items add up to a revealing experience which spells a liberal education for the teacher. He will come back to school strengthened in point of view and more confident in his own program.

Employees upgraded. This matter has been discussed already. It is mentioned here to identify it as one of the benefits and for emphasis. Incidentally, we are only at the beginning of possibilities in the plan of upgrading employees for specific jobs. The future will have much in store.

Boosting production. This is not to be thought of as a benefit to employers alone. True, a step-up in output will aid management to meet dead lines on contracts, with all that goes with it. But we are thinking here about benefits to the nation at large. Every increase in war materials will reduce the number of lives lost by the Allied forces. There is much at stake in this program.

Elimination of breakage and loss. It is an idle dream to suppose that inexperienced help can go into a shop and use complicated machinery on mass production without breakage and waste. The breakage will occur from improper handling of machinery. It takes but one wrong move to start a milling machine in the wrong manner and ruin a costly cutter. Incorrect use of a micrometer will spoil its accuracy. In the same way green help often wastes considerable raw material. The end result is that an unskilled workman damages equipment, spoils material, reduces the output, and increases the cost of production. Where the in-plant trainer is on the job these losses are reduced.

It was mentioned before that the teacher would receive a liberal education by service on an in-plant training program. The same is true for the supervisor. However sequestered school people may be within the confines of the schoolhouse, in the busy and noisy centers of industry there is a different story. In the interests of a better understanding of the problem of emergency war training this is good for both teacher and supervisor. And from the standpoint of procedure both must "raise their sights." There are some definite things to be considered under the head of supervision.

Supervision

The original contact. An in-plant training program doesn't just happen overnight. Industry has been meeting its problems for years. Traditions have grown up within the organization. Procedures have become rather firmly established. There are definite ways to go about the business of manufacturing, selling, advertising, and hiring help. As it became necessary, upgrading within industry took place, either by apprenticeship or by trial and error. Whatever the plan, the industries that have survived have been able to meet the demands for workmen. But the emergency call for war goods in the past few years has upset all calculations. Employers have been looking about eagerly, even desperately, for skilled people. In such a crisis new plans are born. Schools approached industry with an offer to teach their unskilled employees on the job. In some cases management made the overtures. Conferences took place, ways and means were discussed, programs were set up, and plans were launched. All this involved a survey of the operations being performed by a group of employees to see what skills they lacked and to determine if they could be trained to an acceptable degree of proficiency. Would the shop surroundings, layout, etc., be conducive to instructional procedures? Is the product such that an increase in skill on the part of workmen will result in enough improvement to warrant the undertaking? These questions and others come up for consideration during the initial contacts.

Selecting a teacher. As indicated before, the teacher is a very important factor. Careful selection is one of the problems of supervision. Promiscuous assignment of teachers to an in-plant program may often doom the project to failure. One mistake would be to send out a teacher on the basis of a light load in school, and the fact that he can readily be spared. He might still be the best man for that job but other conditions must be met. Can he get along well with the people in industry? Will he adapt himself quickly to the shop surroundings or will he strike fire? Is he

a good mechanic, able to hold up his end of the job under the scrutiny of the so-called "old-timers"?

Launching the teacher. After a good selection has been made, the next step is to properly introduce the teacher to the industry and to see that the setup is ready for action. The supervisor should go over the arrangements for class movement with the teacher and plant officials. An understanding should be reached as to class schedules. Matters of jurisdiction should be settled at the beginning. It should be definitely understood that the teacher is to instruct, and that problems of production are to remain the responsibility of management. Other matters will come up for discussion, according to local conditions.

Cooperation with management. This is not just a continuance of the preceding discussion but follows along in rather close sequence. It is easy to continue in old patterns of thinking. The teacher and supervisor have been working in certain grooves for years. Sometimes the groove becomes a rut. And the personnel officers in the plant have their habits of thought, too. It would be fatal if both sides kept on stoutly proclaiming for the point of view most acceptable to them. The teacher and supervisor need to accept the fact that they are conducting a school under entirely different conditions. Management is made up of top officials, superintendents, foremen, personnel officers, etc., all imbued with the pattern of procedure in their plant. The country is calling for production. Into this situation steps the lone teacher, accompanied by a supervisor. It would be well for the program if they would look around a bit, familiarize themselves with conditions as they are, and devise an instructional procedure that will give the best results in that place. That does not mean that supervision should be spineless.

Appraising the instruction. And then there is the very essential part of supervision to be done in connection with the teaching. A proper records system should be set up. Progress of students should be carefully checked. When trainees are brought up to the point of acceptable proficiency they should be withdrawn from class and others put in. The supervisor may need to arbitrate varying points of view. He is the spokesman for the school and has much to do with deciding problems of procedure.

Results

Chickens should not be counted before they are hatched. In the same sense the results of a movement cannot be measured at the beginning. It is too early to say with any degree of definiteness what may come from the program of in-plant training. But it is interesting to look ahead, and perhaps some straws in the wind will be discernible, even now.

Better workmen. In the first place we are sure that the plan is producing better workmen. Employers make categorical statements about the greater skill displayed by employees. When many foremen report improvement the facts can be accepted. Along with this is an upturn in production. As a corollary this type of instruction fills the needs more specifically.

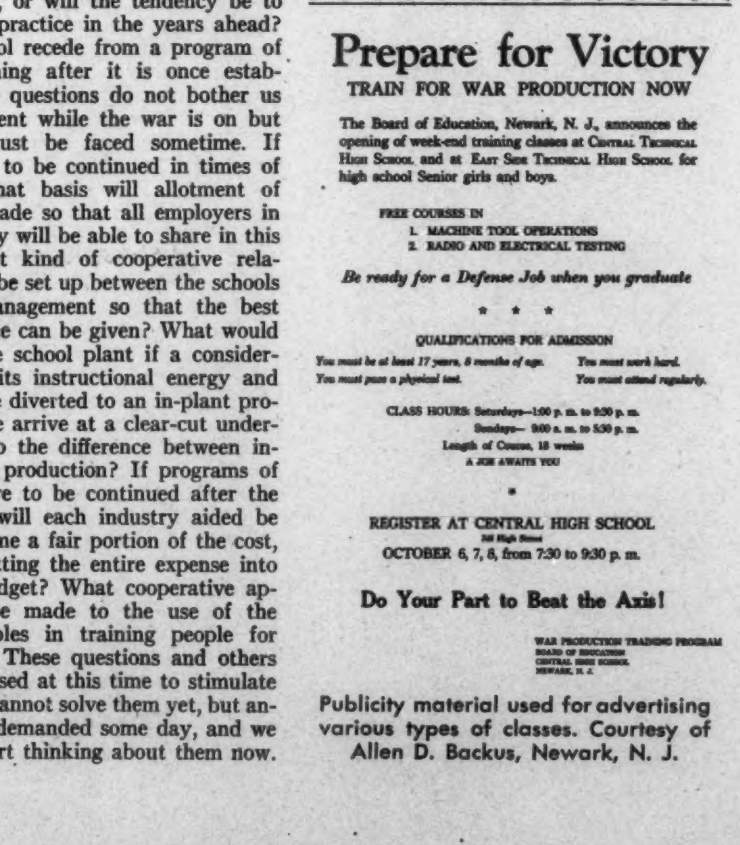
School is better accepted. Secondly, the school becomes better accepted in the community. Teachers who have spent some years in the field of vocational education appreciate the fact that these schools, the same as other public institutions, must be understood to be accepted. It would be folly to attempt to go on unmindful of community reaction. During the recent years of intense war production the country has turned to the vocational schools to take over this training program. Many individual employers who heretofore have known about the whole plan of vocational education as another public agency, good for people who cared to attend, have now come to appreciate its usefulness to them in their training needs. The meaning of all this can hardly be gauged at present. It is fraught with great possibilities for the future.

Policy. It is too early to decide upon matters of policy. Further experience and continued practice will finally crystallize into established procedure. But there are some matters that need consideration even at this early date. School administrators need to realize that going out into the shops to teach school is an innovation. Is it to be understood as an emergency measure only, or will the tendency be to continue the practice in the years ahead? Can the school recede from a program of in-plant training after it is once established? These questions do not bother us much at present while the war is on but the issues must be faced sometime. If programs are to be continued in times of peace, on what basis will allotment of training be made so that all employers in the community will be able to share in this service? What kind of cooperative relationships can be set up between the schools and plant management so that the best possible service can be given? What would happen to the school plant if a considerable part of its instructional energy and resources were diverted to an in-plant program? Can we arrive at a clear-cut understanding as to the difference between instruction and production? If programs of this nature are to be continued after the war is over, will each industry aided be asked to assume a fair portion of the cost, instead of putting the entire expense into the public budget? What cooperative approach can be made to the use of the Manning Tables in training people for specific jobs? These questions and others are merely raised at this time to stimulate thinking. We cannot solve them yet, but answers will be demanded some day, and we had better start thinking about them now.

Conclusion

Looking at the movement in its entirety, the schools have stepped out boldly to do a job that had to be done. Employers have realized the value of the plan. The country is reaping the benefit. American initiative will find a solution to difficult problems. In-plant training may prove to be a move of historical significance.

It is pleasant for those of us who have closed our formal schooling to look back across the years and to revel in memories of persons and events. It would be profitable for those of us who now instruct to attempt to characterize the small group of teachers who served us best and who really pleased and enthused. In my own case it was the teachers who were versatile in attack, to whose classes we youngsters went without sureness of what would happen, from whom we trouped with satisfaction borne of the breaking of monotony. Those who had only one method, who exacted a uniform response, who advanced by rule-of-thumb, and who would not be distracted or diverted have been almost forgotten. The adaptable, casual, yet purposeful ones are remembered and revered. They taught us most, led us easiest, and pushed us farthest. They are most entitled to respectful memory.—*Homer J. Smith.*



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Publicity material used for advertising various types of classes. Courtesy of Allen D. Backus, Newark, N. J.

Teacher Training After the War

WILLIAM T. BAWDEN*

There has never been adequate recognition of the fact that the teacher of industrial arts must, first, be a capable teacher, with the same professional preparation, scholarship, and personal qualifications demanded of other teachers with whom he works, but, in addition, he must have industrial knowledge, skill, and experience which cannot be obtained within the limits of time and expense which are adequate for the preparation of other teachers. Without exception, the highly successful shop teacher is a man who has had to make dual preparation for his job, at an expense well beyond that required of the teacher of any other subject of equal rank. Very seldom are these additional qualifications and this extra investment recognized by appropriate increments in compensation.

Employers of teachers quite often know exactly what they want. The teacher-training institutions receive the most detailed specifications of requirements. At the close of each letter, almost as an afterthought, is a statement of "the limit of salary we can pay." The combination of requirements and salary offered is sometimes ludicrous.

If conditions in these matters were out of joint in peacetimes as we knew them, there is no reason to expect them to be better articulated after the war. It may be futile to speculate, for no one can possibly forecast what conditions and demands we must meet after the war. Nevertheless, since everybody is doing it, one more "commentator" can hardly add much to the confusion.

Increased Demand for Industrial Arts

Following the close of hostilities and the return to whatever may then be regarded as "normal conditions," I believe we may expect to see a substantial increase in the demand for industrial arts, not only in the elementary school but especially in the junior and senior high school. The figures showing the demand in industry and in the armed forces for men and women who can do things with their hands must be familiar to everyone by this time. There is ample evidence that as a nation we narrowly missed disaster. There is evidence also that one major factor contributing to our escape is our native mechanical aptitude and adaptability, and our ability quickly to absorb training in manual skills.

We have had demonstrated, perhaps as never before, the significance of mechanical skill and intelligence widely diffused among our population. We know also that the need will be equally valid after the war. What we do not know is whether we as a nation have really learned this lesson. We did not act as if we learned it after World War I.

If we are to have mechanical skill and intelligence widely diffused among our population, it is certain that we must have more and better industrial arts in the public schools, for this is the logical and indispensable prerequisite to the attainment of that goal. Hence, it is reasonable to look forward to a time when there will be more and better trained industrial-arts teachers.

Problem of the Teacher-Training Institution

There will undoubtedly be increased emphasis on *practical* training for teachers of all types of shopwork. To meet this demand, teachers of shopwork will be expected to know more about their specific fields of endeavor than can be acquired as students-in-training in the usual industrial-education department in the teacher-training institution. The combination of knowledge-skill-practical experience that will be demanded of teachers cannot be obtained in the teachers' college alone. Such preparation as the teachers' college can give must be supplemented by successful experience under approved conditions in industry.

These circumstances point up a serious problem for the teacher-training institution in the organization and maintenance of the staff of the industrial-education department. A growing demand for practical training is only part of the story. There is also the demand from accrediting agencies, such as the North Central Association of Colleges and Secondary Schools, for higher and higher standards of qualifications for members of the faculties. Minimum scholastic requirements begin with the bachelor's degree. A certain minimum proportion of the staff must hold the master's degree, and a certain proportion the doctor's degree.

In response to this latter stimulus, the industrial-education departments of teacher-training institutions for some time have been endeavoring to increase the number of men on their staffs holding the advanced degrees. A slow and difficult process in peacetime, it has been all but discontinued for the duration. Attempts at solution of the problem must be resumed after the war.

A Suggested Solution

A tentative approach to this problem, if not a solution, may be suggested for consideration and discussion. We must frankly recognize the necessity of insisting upon the practical background of training and experience indicated for teachers of shopwork for prospective teachers of shopwork. We must also concede, I believe, that this background is not likely to be associated with either the ambition or the opportunity to earn the Ph.D. degree. At the same time, we cannot evade the demands of the standardizing agencies, but must include in the staffs of the industrial-education departments (as of other departments) certain minimum proportions of men holding the advanced degrees.

Are we not then forced to the conclusion that it is advisable, if not imperative, to effect a separation of functions? We may recognize that there are certain positions in the faculty of the college department of industrial education the duties and responsibilities of which require the incumbents to hold the doctor's degree; also, that the duties and responsibilities of certain other positions, equally essential, require qualifications which are incompatible with the holding of the doctor's degree. If it be conceded that there may be a valid basis for distinction in the allocation of duties, the way is open for at least a partial solution of the major problem.

A tentative distribution of assignments would provide that courses in theory, philosophy, history, methods, supervised teaching, and the like would be taught by men holding the doctor's degree. These instructors would be the only ones eligible to participate in the graduate program, if any. These men should be well grounded in at least two or more lines of industrial-arts shopwork and drafting. Each man should have had an approved number of years of successful teaching and supervisory experience, sufficient to insure adequate understanding of the problems of the shop teacher. Before being considered eligible to appointment to the teacher-training faculty the candidate should give evidence of professional activity to the point of attaining a position of recognized leadership in industrial arts. The degree of personal proficiency in the manipulative skills of shopwork does not need to be as high for this type of position as is required for teaching the shop courses.

The second major assignment in the division of labor would be the teaching of courses in shopwork and drafting. This responsibility would fall on a carefully selected group of men most if not all of whom should be graduates of approved teacher-training institutions, holding the bachelor's degree. In addition, each man should have, or should secure, sufficient practical experience in industry to com-

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mand and hold the respect of industry. This experience should be in one or more lines of industry closely related to the course or courses taught.

A certain proportion of these men may be expected to hold the master's degree, but the degree should not be considered a satisfactory substitute for either practical experience or mastery of the subject taught. A year's experience in a modern industrial plant under favorable conditions might well prove to be worth more to the teacher-training institution, to the college students under his instruction, and later to unnumbered high school boys, than a year of graduate study leading to the master's degree. Much would depend on the individual.

Only in exceptional cases would men in this group be assigned to teach courses in theory, philosophy, and the like, except as these phases are integrated with the shop courses taught.

A Futile Quest

In conclusion, I believe we must abandon our search for shop teachers who possess the necessary background of technical and professional preparation, skill and mastery of shopwork, and practical experience in industry sufficient to qualify for teaching advanced courses in shopwork to prospective teachers, expecting them also to possess the doctor's degree, professional leadership qualifications, and a long list of scholarly attainments. Schools and colleges do not offer enough compensation to secure the services of the more capable men who satisfy either of these sets of qualifications. On this ground alone we are not justified in attempting to discover or to prepare men who possess both. We should not discourage capable men from going ahead with plans for graduate work. We should not spread discontent and dissatisfaction among those who for good reasons should not invest time and money in seeking advanced degrees.

Preinduction Training in the Schools

THOMAS DIAMOND*

The practice of providing for the needs of the individual student has become well established in our schools. It is not surprising, therefore, that since military service is to be the immediate future of so many secondary school students, school authorities have concerned themselves with what could be done to prepare these prospective inductees for the job ahead. The problem is not only to provide young men with a foundation which will enable them to profit more readily from the postinduction training program of the Army; it is also that of helping the individual to make the most of his abilities and aptitudes during his military service.

Change in Type of Inductee

The War Department has established schools for the training of Army personnel in the numerous specialities which modern mechanized warfare requires. In the early stages of the war those who came to Army schools, through the draft and through enlistment, were men of experience in various occupations. The problem of these schools at that time was to a considerable extent one of training the men to apply the skills they already possessed to the tasks to be performed in the Army.

As time passed, the supply of skilled men coming into the Army decreased and inductees were drawn more and more from the younger men with a limited background of vocational experience. In order to provide these younger men with some skill and knowledge which would prepare them for the postinduction training of the Army, the War Department proposed to the U. S. Office of Education that the schools establish specific training in one or more occupational fields, common to civilian life, in which the Army needs trained men.

*Professor of Vocational Education, University of Michigan, Ann Arbor, Mich., and Consultant for the Civilian Preinduction Training Branch, Industrial Personnel Division, Headquarters, Army Service Forces.

A Cooperative Program

The U. S. Office of Education interprets to school people the needs of the Army which preinduction training can help to meet. Schools are responding by providing special education for prospective inductees. The schools supply the instructors, supervision, and facilities; the War Department through the U. S. Office of Education furnishes suggestions helpful to the schools in reaching the training objective. Because of this cooperative plan, it is important that each school person have clearly in mind what is meant by preinduction training, what it includes, and how it may affect the existing program in his school.

Two Types of Preinduction Training

Preinduction training is preparation given to prospective Army inductees to get them ready for more effective participation in military life and training, and hence for better adjusted and more skillful service as soldiers. In general, a preinduction program will include two distinct types of training. First, there is that type which deals with the needs common to all soldiers, regardless of rank or branch of service. These needs include:

1. Knowledge of the background, conduct, and issues of the war
2. Understanding of Army life and organization
3. Understanding of the processes of induction, classification, and assignment
4. Physical fitness and health, and an appreciation of the principles underlying them
5. Basic skills in reading and language communication
6. Simple mathematical skills and abilities

To assist schools in the organization of preinduction training in these areas, materials are now being prepared. They deal with orientation to Army service, health, language and reading, mathematics and guidance.

The second type of preinduction training relates to the specialized occupational needs of the man in the Army. This area includes prevocational and vocational training in broad fields, as a foundation for later specialization in one of the more than 650 Army jobs. Here also the schools can and are making a definite contribution, through regular vocational schools, vocational departments, and trade schools; and in industrial-arts shops equipped for specific skill training. It is with this occupational phase of the program that the present article is mainly concerned.

Five preinduction training outlines (fundamentals of electricity, machines, shopwork, auto mechanics, and radio) were distributed to the schools last year. The bulletins presented suggestions for instruction on a prevocational level, so that prospective inductees might acquire some understanding of the principles underlying work in important Army occupations. This instruction is not to be considered as a substitute for the vocational training which the schools may provide.

For the guidance of schools in providing basic shop training for Army job skills, the War Department in cooperation with the Vocational Division of the U. S. Office of Education, has recently issued bulletins as follows:

1. *Preinduction Training in Vocational Schools, Vocational Departments, and Trade Schools* (PIT-330). This bulletin, addressed to school administrators, supervisors, and teachers, indicates Army job skill needs in broad occupational areas and discusses ways of organizing and ad-

ministering programs of preinduction vocational training.

2. *Preinduction Vocational Training in Auto Mechanics* (PIT-331). The teacher of auto mechanics will find in this pamphlet descriptions of typical Army jobs for which his instruction will provide a general basis. The most important section of the bulletin presents a list of suggestive instructional units.

3. *Preinduction Vocational Training in Machine Shop Practice* (PIT-332). Same organization of content as in PIT-331.

4. *Preinduction Vocational Training in Aircraft Maintenance* (PIT-333). Same organization of content as in PIT-331.

5. *Preinduction Vocational Training in Electrical Signal Communication* (PIT-334). Same organization of content as in PIT-331.

State directors for vocational education are assisting in the distribution of these pamphlets, so that every teacher of a vocational course who can provide preinduction training will secure a copy.

Types of Schools or Classes That May Contribute to the Program

Since our schools have long provided vocational courses intended to prepare persons for more effective participation in occupations, they are, therefore, in a position to give the kinds of training needed as preparation for the Army. Whether this training is done in an industrial-arts class or a vocational class, in a day class or a night class, matters little. The main point is that, in many cases, the contribution of the school provides an excellent base upon which Army instructors can build the special training needed for Army specialist jobs.

How Much Should Be Taught?

The question of how far a prospective inductee should carry his training in any special area is quite pertinent. Obviously, this will vary with the personal circumstances of the individual and with the opportunities in the school. If the student has considerable time before he is to be inducted, much of the content of the occupational field may be covered. This is particularly applicable in the case of the long-range vocational courses. On the other hand, if he will have only three months before he is called, only a minimum of training can be given. This suggests to the vocational teacher that his course should be arranged in units, each unit being more or less complete in itself. Thus if the student can stay in the class only a short time he may develop acceptable skill in a single unit, such as service skills in auto mechanics. But whether the time be long or short, the training much or little, the vocational schools can help the Army by giving preliminary occupational training prior to induction.

Again, some boys are more adaptable or can assimilate more than others. The question of individual differences must always be considered in any training program. For this reason, we should be satisfied, if in a special case, we are successful in developing one skill in a student. However, we have the responsibility of carrying the brilliant student as far as time and his talents permit. Students qualified by ability and interest to seek entrance into the Army Specialized Training Program will benefit from a thorough college preparatory course emphasizing advanced work in high school science and mathematics. All students should be encouraged to select a special field pertinent to their interests and aptitudes and to Army needs, and to take just as much training as circumstances will permit. The Army is made up of trained men on all levels of ability.

Then, too, all schools are not equally well equipped for preinduction training. Those located in larger communities may have elaborately furnished shops and laboratories, while others in smaller towns or rural communities may have little or none. It is not expected that all schools can contribute equally to the program; but all may do something that will help. Those more adequately equipped may provide comprehensive training in trade skills, leaving to the Army only the problem of teaching the application of these skills to related specific Army jobs. Those with limited facilities may have to confine their efforts to teaching the simple hand-tool skills needed in the Army, or may have to enlist the cooperation of local shops and garages.

Preinduction Training for Those Out of School

It must not be assumed that preinduction training is only for those young people now attending the all-day school. Adult workers who expect to enter the Army should be provided with an opportunity to obtain training before induction which will help prepare them for specialized Army jobs. The worker may secure this training in either of two ways. First, he may enter one of the evening or part-time trade extension classes commonly found in the vocational education programs in our industrial communities. Or, second, if he is employed in an industry for which war-production training courses have been organized, he may enter these courses for the purpose of equipping himself for an Army speciality; provided that the training he takes will prove useful to war industry if he is not inducted. However, it should be made clear to administrators of these programs that the extension of these privileges to prospective inductees should be arranged in accordance with accepted standards set up by the agencies responsible for the administration of the program within the state.

Each school is expected to do what it can with its present staff and facilities. No state or federal funds have been earmarked specifically for the operation of the preinduction vocational training program. However, when the courses and the staff meet the standards set up by a state for vocational work done under the Smith-Hughes or George-Deen Acts, the state director for vocational education may find it possible to assist in the payment of teachers' salaries. This is a matter which can be settled only by the appropriate state officials charged with that responsibility.

Will Preinduction Training Be Recognized?

It should be understood that assignment of inductees must be made on the basis of Army needs at a particular time. This is the controlling factor, despite the consideration which is given to the inductee's preferences, aptitudes, training, and experience. Inductees should know that every effort is made to assign them to jobs in which they are interested and for which they have training; but they should also recognize that the Army may have to assign them to some other job because of current needs. However, the inductee who has had training related to an Army specialist job is much more likely to be assigned to that job than is the man who has had no preparation for it. As a matter of further information, classification and assignment officers are directed to record the new soldier's preinduction training on Form 20 (the soldier's record which follows him throughout his military service) at the time he is inducted, and to give such training due consideration in making his assignment for further training in Army schools.

TEACHING

Leonard E. Schmidt*

We have them in our shops each day
For a year, or two, or more,
And we try to fill their minds with facts
Gleaned from the Ages' store.

We watch them as they make the change
From beginner to worker fair,
And know that the fruits of our teaching
Have not been wasted there.

Then comes the day when they leave us,
How we wish to walk at their side,
To help them to really "get started"
And their first doubtful efforts guide.

But soon there's a letter, then two, maybe three,
Each one just "chock full" of joy,
And we sit back and grin, for there's happiness in
Guiding the steps of a boy.

*Lincoln Hall Vocational Shops, Lincolndale, N. Y.

Instructor Training Through Observation and Application

HOMER C. ROSE* and ROY E. HOWARD**

Students of the science of teaching will gain some measure of judgment and appreciation of effective teaching through thoughtfully watching others teach. During this period of observation the student teachers' attention should be directed to all of the various points that contribute to or detract from the lesson being taught. This can be done best through the planned use of a special observation rating sheet, such as is shown in Figure 1. This rating sheet consists of a list or inventory of the points to be considered in presenting a lesson.

Let us assume that a class of student teachers has studied and discussed the various aspects of teaching, such as preparation, explanation, presentation, discussion, as well as the use of various training aids and devices. The students have had a thorough introduction to the theories, principles, and approved techniques of teaching, and now need practice and a period of application in order to develop teaching skills.

One of the student teachers has prepared a demonstration and is ready to present this lesson to his classmates. His objectives are:

(1) to present the material to the best of his ability;

(2) to obtain from his classmates their careful evaluation of the various points that make up his presentation;

(3) to modify his techniques and to make them more effective by following the suggestions made by the class and by the teacher trainer.

The objectives for members of the class are:

(1) to note the contributing factors, such as the *introduction sells the idea, challenging questions, good use of humor,* etc.

(2) to note detracting factors, such as *objective not definite, questions too involved, did not define new terms,* and the like.

(3) to modify their own performance in the light of the good or bad practices seen as other members present their lessons.

Let us assume now that the lesson is being taught. As the student teacher presents his lesson the remainder of the class observes and attempts to evaluate the performance. At the close of the presentation each of the observers fills in the check list, shown in Figure 1. The instructions contained in Figure 2 tell the observer what to do.

In order to fill in the rating sheet effectively, the students must draw upon their past experiences in teaching and on their study of teaching techniques. To merely mark the items good, poor, o.k., etc., does not require much thought or much knowledge, nor will such marks be useful to the person being marked. On the other hand, if the item "Manipulative Skill" is marked with the words "a little jerky" or the item "Objective of Introduction" is marked "objective does not fit the lesson taught," etc., the teacher whose work has been

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RATING SHEET FOR STUDENT INSTRUCTORS' DEMONSTRATION

Student Instructor: John Doe

Title of Demonstration: _____

PREPARATION		Mark
1.	Written lesson plan: Plan easy to follow	3
2.	Class arrangement: All can see and hear	4
3.	Tools and equipment: Typical equipment used	3
4.	Selection of information: some points unnecessary	2
5.	Selection of standard practice: Best shop method	4
6.	Selection of method: Group performance method could be most effective	2
MANNERISMS AND APPEARANCE		**Mark**
7.	Movement: Nervous body movement	2
8.	Posture: Hands on hips	2
9.	Teaching position: Talks to the charts	2
10.	Dress: Neat - fresh starched appearance	4
PRESENTATION		**Mark**
11.	Objective and introduction: Objective stated well	3
12.	Questions: Clear concise questions	4
13.	Enthusiasm and forcefulness: Convincing	4
	Total	39

PRESENTATION (Continued)		Mark
14.	Use of technical terms: assume students understand	2
15.	Control of discussion: surplus information allowed	2
16.	Summary: Complete yet brief	4
17.	Student application: New application, some questions should be left to class	3
18.	Manipulative skill: Operating steps stand out	3
19.	Aids and their use: Large, clear, understandable	4
20.	Order of presentation: Not logically developed	1
VOICE AND VOCABULARY		**Mark**
21.	Enunciation and pronunciation: Every word understood	4
22.	Voice quality and volume: Shows quite a little tension	3
23.	Rate of speaking	4
24.	Choice of words: Technically correct	3
	Total	33
	Total points from other side	39
	Total points	72

Additional Remarks: _____

Monitor's Code No. 33

Fig. 1. Front and reverse side of rating sheet, with remarks noted by an observer

Instructions for the Observers

How to use the rating sheet

All of the items listed on the sheet have been covered in our conferences. The list is used to remind you of the points that make up the presentation of a lesson and help you to rate the presentation accurately.

Procedure:

1. Observe the presentation carefully. You will be marked on your evaluation of the lesson.
2. Make a written comment after each of the items. Make these comments very specific. Avoid general ratings such as good, poor, and o.k. See example below.
3. Place a rating under the heading (mark) which follow the various items to represent your evaluation of the item. Use the following scale:

Unsatisfactory	0
Below average	1
Average or good	2
Better than average	3
Excellent	4

4. Total the marks.

REMEMBER: Your ability to judge the teaching of others is an indication of your ability as a teacher.

PRESENTATION		Mark
Objective and introduction	Make student want to learn	3
Questions	Clear and concise	3
Enthusiasm	Good use of humor	4
Use of technical terms	Correctly defined	3
Control of discussion	Resourceful	4
Summary	Incomplete	1
Application	Students ready to work	3
Manipulative skill	operating steps stand out	4
Use of aids	All students could see	2
	Total	27

Fig. 2. Instruction sheet with sample of marks and comments on one part of the rating sheet

evaluated has a definite point on which he can work to improve himself. The student who marked a sheet as shown in Figure 2 has had to analyze the presentation and apply what he learned in theory of teaching to a specific situation. His ability to do this is a measure of his practical knowledge of teaching techniques. The practice of critically observing the teaching process gives him experience in analyzing the science of teaching.

When the rating sheets have been filled in according to the directions, they are collected and turned over to the teacher trainer for his inspection.

Figure 1 represents a typical marked sheet.

The check sheets should be used by the teacher trainer to evaluate the judgment of each student teacher. Poor judgment on the part of any student will come to light through the remarks he has made.

The sheets are then given to the student who presented the lesson for his inspection and study. Since the remarks on the sheet are analytical, the student teacher has a good estimate of what he can do to improve his teaching skill. Each student should present one or more lessons, and each student should evaluate every lesson. This repetition leads to effective habits of teaching.

As a further aid to all in using the check list, the following points have been listed. These are suggestive of the type of analytical remark that should be found on the marked check sheets. Note the omission of single words: good, average, poor, o.k., etc. Thoughtful answers are required.

Typical Analytical Remarks From Marked Check Sheets

1. *Written Lesson Plan*

Contributing	*Detracting*
1. All necessary plans were made	1. Too detailed
2. Steps in teaching a lesson were followed	2. No plan used
3. Plan easy to follow	3. Evidence of lack of planning
4. Blackboard sketches indicated in plan	
5. Very well planned	

2. *Class Arrangement*

Contributing	*Detracting*
1. All can see and hear	1. People at the rear could not see
2. Used chalk line on floor	2. Crowded
3. Moved class as per plan	3. Some could not hear
4. Proper	4. Students face the sun
5. Good for the particular classroom	5. Too close to other groups
	6. Students not grouped together
	7. Too low to see visual aids on table
	8. Equipment too small for this arrangement

3. *Tools and Equipment*

Contributing	*Detracting*
1. Tools well selected	1. Tools dirty
2. Equipment well placed	2. Tools list incomplete
3. Equipment clean	3. Poor selection of equipment
4. Facilities for clean work	4. Equipment out of order
5. Typical equipment used	5. Not listed before lesson
6. On hand	6. Poorly placed
7. Displayed on table where class could see	7. Too much distance between demonstration bench and visual aid

4. *Selection of Information*

Contributing	*Detracting*
1. Every point necessary	1. Some points unnecessary
2. Good basic lesson for mechanics	2. Not complete enough
3. Complete	3. Not the latest information
4. Self-explanatory	4. Does not follow text
5. Logical	5. Too much for time allowed
6. Only essential information was taught	6. Not much evidence of research or thought
	7. Mixed major points of information and steps of operation
	8. Information not technically correct

5. *Selection of Standard Practice*

Contributing	*Detracting*
1. Best field method	1. Dangerous practice
2. Best shop method	2. Out of date
3. Basic practice stressed	3. Does not conform to trade practice
4. Proper for the situation	4. Gave wrong names for some parts
5. Exactly correct	5. Not technically correct

6. *Selection of Method*

Contributing	*Detracting*
1. Good for small group	1. Subject could be taught better with conference
2. Good subject for a demonstration	2. Poor — too much talking
3. Meets objective	3. Not lecture material
4. Proper for the type of student	4. Mixed "doing unit" demonstration with conference material
5. The best combination for the lesson	5. Group performance method would be more effective
6. Simple enough to be effective	
7. Made it interesting	
8. Best possible	

7. *Movement*

Contributing	*Detracting*
1. Calm and at ease	1. Walks about too much
2. Free from constraint	2. Swings arms
3. Gestures fit subject	3. Jabs pointer
4. Natural pleasing movements	4. Looks out window
5. Controlled	5. Plays with parts
6. No unnecessary movements	6. Talks with hands
7. Quiet and not distracting	7. Runs hands through hair
8. Looks directly at class	8. Nervous body movement
	9. Looks down at floor
	10. Paces floor
	11. Sways about
	12. Moves about too much
	13. No gestures — moves feet about
	14. Back and forth too much
	15. Entirely too much
	16. Plays with pointer

8. *Posture*

Contributing	*Detracting*
1. Hands at sides	1. Leaned on podium
2. Pleasing and natural	2. Hands on hips
3. Erect	3. Hands too rigid
4. Stands up — all can see	4. Head down
5. Relaxed but not sloppy	5. Sways about
6. Not awkward	6. Slightly stooped
	7. Hands in pockets

9. *Teaching Position*

Contributing	*Detracting*
1. Stands to one side	1. Does not face class
2. Assumes natural position	2. Talks to board
3. Stands to one side of aid	3. Stands in front of aid
4. All students can see	4. Rocks on front edge of platform
	5. A little too much movement
	6. Leans on table causing shoulder to push up
	7. Leans on pointer
	8. Talks to parts — obscures them

10. *Dress and Personal Appearance*

Contributing	*Detracting*
1. A model of neatness	1. Dress eccentric
2. Very clean	2. Dirty shoes
3. Appropriate for his work	3. Clothes do not fit — pants too short
4. Proud of his hands	4. Fingernails too long
5. Proper for the work	5. Hair too long
6. Neat — fresh starched appearance	6. Not dressed for the job
	7. Needs cleaning and pressing

11. *Objective and Introduction*

Contributing	*Detracting*
1. Objective stated well	1. Objective does not fit lesson
2. Introduction sells idea	2. Objective not definite
3. Makes student want to learn	3. Too long and dull
4. Students know why they are to learn the material	4. Not given
5. Clearly defined	5. The "why" of the lesson not included
6. Clearly stated to make students interested	6. Did not sell subject
7. Student knows what he is to learn, and when and why	7. Students do not know what is expected of them

12. *Questions*

Contributing	*Detracting*
1. Stated clearly	1. Did not ask questions
2. Challenging	2. Poorly timed
3. Brings out reasoning	3. Too long
4. Require pupils to think	4. Not understood
5. Encourages complete answers	5. Yes — no type only
6. Calls on all students	6. Allows group answers
7. All questions answered	7. Rotation of recitation
8. Clear concise questions	8. Calls on student first
9. Questions asked before students were called on	9. Pause too short
10. Call students by name	10. Vague
11. Asked at good time	11. Students could not hear
12. Planned before presentation	12. Students do not stand
13. Designed to cover subject taught	13. Mostly recall
14. Asked after each step	14. Instructor should repeat questions
15. Required recall and application	15. Should ask more questions
	16. Too involved
	17. Not enough time allowed for thought
	18. Answer obvious
	19. Not clear
	20. Does not repeat question asked by student before answering question

13. *Enthusiasm and Forcefulness*

Contributing	*Detracting*
1. Forceful	1. Could show more
2. Sells idea	2. Acts bored
3. Good use of humor	3. Shows little interest
4. The smile helps	4. Acts tired
5. Sense of sincerity	5. Too solemn
6. Arouses interest	6. Appeared to be trying to get through in a hurry
7. Master of the situation	7. Could be improved by change of voice from time to time
8. Professional manner	8. Shy
9. No antagonism	9. Did not act interested
10. Confident	10. Sounds memorized
11. Forceful without making it obvious	11. Talks in one tone
12. Convincing	12. Talks too hard
13. Brought out key points	13. "Bullish"
14. Enough to make it interesting	14. Overbearing
	15. Too strong for class size
	16. Somewhat apologetic
	17. A little lagging

14. *Use of Technical Terms*

Contributing	*Detracting*
1. Blackboard technique good	1. Did not define
2. Terms emphasized	2. Too many new terms at one time
3. Good questions on terms used	3. Assumed students understand
4. Proper trade terms used	4. Incorrectly defined
5. Correctly defined	5. The word *flux* was poorly used
6. The meaning of the word *flux* was well illustrated	6. Should define terms used
7. Not too technical for the class	
8. Indicate wide experience	

15. *Control of Discussion*

Contributing	*Detracting*
1. Interesting remarks	1. Shows lack of plan
2. Very tactful	2. Got out of hand
3. Good leading questions	3. Too long
4. Essential points emphasized	4. No summary
5. Control of class	5. Allows argument
6. Alert to infractions	6. Surplus information allowed
7. Requires students to speak so all can hear	7. Off on tangent
8. Resourceful in handling questions from class	8. Not at ease
9. Used to good advantage	

16. *Summary*

Contributing	*Detracting*
1. Important points stand out	1. Hard to follow
2. Simple and understandable	2. Incomplete
3. Vital and purposeful	3. Involved
4. Interesting	4. Too long
5. Good illustrations	5. Contradicts the presentation step
6. Summary included all points of importance	6. Too much detail
7. Complete yet brief	7. Too brief
	8. Did not leave enough time

17. *Student Application*

Contributing	*Detracting*
1. Student ready to start work	1. No chance for application
2. Good introduction to practical work	2. No introduction to application
3. Assignment definite	3. Students do not understand what is to be done
4. Each student has chance to try out the operating steps	4. Could use more application
5. Students know what is expected of them	5. More application-type questions should be asked
6. Students understand what to do	
7. Application through use of problem was effective	
8. Students do actual assembly	

18. *Manipulative Skill*

Contributing	*Detracting*
1. Accurate	1. Needs practice
2. Expert	2. Too jerky
3. Clever	3. Fumbling
4. Master of details	4. Clumsily done
5. Excellent — not too fast for a demonstration	5. Awkward
6. Operating steps stand out	6. Operating steps do not stand out in demonstration
7. Good use of assistant in handling equipment	

19. *Aids and Their Use*

Contributing	*Detracting*
1. Kept covered until used	1. Awkwardly handled
2. All students could see	2. Used hand instead of pointer

Contributing	*Detracting*
3. Good use of pointer	3. Displayed all the time
4. Made good use of helper in presenting the aid	4. Movement too fast — students do not have time to see the part mentioned
5. Made full use of aid	5. Hard to see
6. Amusing and original	6. Too many nonessentials
7. Well displayed	7. Not in scale
8. Used as steps were brought out	8. Contains unnecessary details
9. Uncovered portion of chart at a time	9. Lettering too fancy
10. Aid helps attain objective of lesson	10. Too heavy
11. Important parts stand out	11. Too light will not last
12. Lettering very readable	12. Out of date
13. Colors emphasize important parts	13. Model could be better
14. Only essentials are included	14. Used too rapidly
15. Good visual aids but needs practice in using them	15. Well covered when not in use
16. Numerous and satisfactory	
17. Blackboard drawings helped considerably	
18. Stimulated interest	
19. Humorous — they will be remembered	
20. Large, clear, understandable	
21. Well covered	

20. *Order of Presentation*

Contributing	*Detracting*
1. Order well planned	1. Does not know subject
2. Short summary helps	2. Left out necessary steps
3. Questions well timed	3. All questions left until last
4. Taught first things first	4. Failed to explain early in lesson
5. Taught most common things first	5. Not coherent
6. Used first steps to help present others	6. Not logically developed
7. Logical and progressive	7. Confusing
8. Order on blackboard a good way	8. Lacks review of manipulative steps
9. Good for small group	9. Kept jumping from point to point
	10. Should have passed the samples around first
	11. A little jumbled up

21. *Enunciation and Pronunciation*

Contributing	*Detracting*
1. Clear	1. Talks down sleeve
2. Very distinct	2. Muffled
3. Every word understood	3. Foreign accent
	4. Mispronounced technical words
	5. Not consistent
	6. Should practice saying words
	7. Used "and-uh"

22. *Voice Quality and Volume*

Contributing	*Detracting*
1. Agreeable	1. Raspy
2. Pleasant	2. Unpleasant because of harshness
3. Arouses interest	3. Shy quality
4. Could be heard easily	4. Monotone
5. Low and pleasing	5. Showed a little nervous tension
6. No tension, no imitating qualities	6. Too low
7. A pleasing voice	7. Too loud
8. All can hear	8. People in back could not hear
9. Stopped when outside noises were loud	9. Loudness caused student nervousness
10. Sufficient	10. Talked when vehicles were passing
	11. Lisp or other defect
	12. Hard to hear at times
	13. Did not take other noises in building into consideration
	14. Has habit of coughing or clearing throat

23. *Rate of Speaking*

Contributing	*Detracting*
1. Good rate for demonstration	1. Much too fast
2. Instructional steps stand out	2. Too slow
3. Arouses interest	3. Noticeably uneven
4. Stimulating	4. Instructional steps stated too fast
5. Animated	5. Stumble over words
6. Very good — not too fast or slow	6. Jerky
7. Slow enough to create interest in subject	7. Monotonous
8. Proper variation	8. Wearisome and tedious
	9. A lazy voice

24. *Choice of Words*

Contributing	*Detracting*
1. Students understand	1. Gave wrong names
2. Technically correct	2. Not understandable by students
3. Simplest words	3. New words not defined
4. Calls a spade a spade	4. Inadequate
5. Correct nomenclature	5. Repetition of word *your*
6. At vocabulary level of the audience	
7. Always used *best* word	

Typical Remarks:

1. Presentation accurate and well done. Perhaps the summary could be given a little more time in order to emphasize the operating steps.

2. Actual presentation was enthusiastic and forceful. A more thorough preparation on the use of technical terms would make the demonstration stronger.

3. Instructor needs to talk more slowly and to be careful of his enunciation.

4. Instructor should ask more questions at proper checking levels in order to determine the progress of his students in understanding the demonstration.

5. Introduction a little weak because students did not know exactly what was to be learned and how the material will be used.

6. Operating steps stand out clearly and all students have a clear idea of the exact procedure to be followed. Questions were well selected to bring in application of things taught.

7. Subject covered and objective reached.

8. A very good job, interesting, simple explanation, easy to follow.

9. Too much subject for allotted time.

THE ANNUAL INDEX

For purposes of paper economy, the annual index has not been made part of this issue. A free copy of it will be mailed to you if you address a postal to INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, 540 North Milwaukee St., Milwaukee 1, Wis.

Professional Development of Industrial-Arts Teachers

CHARLES M. HERLIHY*

Present status of industrial-arts teacher training[1]

Qualified candidates for industrial-arts teacher training are enrolled in more than one hundred state supported universities, colleges, and teachers' colleges in approximately forty states. This type of specialized professional education has been offered in forty institutions for more than 25 years. Eighteen colleges have departments which were established since 1925. It is safe to say that industrial arts has reached maturity as one of the specialized branches of teacher training in the United States. The public and school administrators have a right to expect sound, constructive, clear-cut recommendations from this group as to policies, procedures, and practice. There is considerable evidence to prove, however, that industrial arts has not been recognized as an integral and essential part of the program of general education. One is dismayed to find so few specific references to the importance and values in industrial arts in such school surveys as:

1. National Survey of Secondary Education
2. Youth Commission Studies of American Council
3. New York Regents' Inquiry
4. Reports of Advisory Committee on Education
5. National Survey of Teacher Education

The teacher-training institutions on the undergraduate and graduate levels must give earnest consideration to the need for a more effective implementation of industrial-arts philosophy in the thinking of the leaders of American education. They determine the official status of this work.

There can be no question about the experience and capacity of the faculties of industrial-arts teacher-training departments. Hundreds of earnest instructors in the professional institutions are certain that the modern industrial-arts program can render significant help in meeting the needs of reorganized secondary school curriculums. American youth must be provided with functional programs of work experiencing in the senior high schools of the future. The real need is for a pragmatic approach to school officials with definite, reasonable, and not too expensive proposals in the form of curriculum changes. The need, in New England, is for team play between industrial-arts leaders and school people who stand ready to cooperate in the necessary experimentation. Professional schools may well provide experimental workshops for such cooperative and continuing study.

The shop teacher's place and function in the ranks of public school teachers

Every professional college of education is committed to the task of helping students to work out the answers for three questions:

1. Why am I teaching?
2. What shall I teach?
3. How shall I teach?

The answers to the first question embrace the objectives of American public education and obviously entail a lifelong search for the most valid aims in education. There is real danger for shopmen in the attempt to predicate the objectives of industrial arts on insufficient premises about education as a whole. One short, isolated course in principles of education is not sufficient in the traditional four-year college program. The development of a satisfying philosophy of education is a challenge which must be met by every successful teacher. Too frequently, the shop teacher is isolated from the ranks of the general educators, not because of hostility or ill will, but because his thinking about the purposes and functions of industrial arts fails to mesh into the accepted aims of schoolwork. There are several basic courses in education which are required in the training of elementary and secondary school teachers which must be covered in undergraduate or graduate work of industrial-arts instructors. We shall be asked to contribute to the planning and reorganization of secondary school curriculums when we present convincing evidence not only of competence in a special field but also an understanding grasp of the accepted policies, objectives, and procedures of general education.

Basic philosophic concepts which determine the industrial-arts teacher-training curriculum

There is an astonishing range of objectives in this field. The influence of Snedden and Bonser can be found in many of the accepted purposes in shopwork. Most of these ends may be classified under the traditional headings, proximate and ultimate. The former include the following:

1. Training in manipulative skills in a variety of materials and experiences
2. Consumer training
3. Handy man repair jobs
4. Prevocational training
5. Implementing the learning of English, arithmetic, civics, and science
6. Training for avocational and recreational purposes

These six objectives are generally accepted and the good shop teacher can point to successful outcomes under each heading in his shop (wood, metal, drawing, printing, general shop). There are five additional aims, however, which have evolved during the past decade. These may be summarized as follows:

1. Training in understanding the nature of our industrial civilization
2. Developing an understanding and appreciation of the nature of industrial materials and processes
3. Training for occupational competence
4. Training in democratic living
5. Training of girls as intelligent members of our industrial society

The above purposes are obviously desirable and necessary. There is little evidence, however, in the northeastern states, that such aims have influenced the actual organization and conduct of any large number of industrial-arts shops.

One may reasonably question the validity of the claim that shop teachers, under present limitations of assigned periods, can find the time to help youth to understand the basic framework of our industrial civilization. Should this important aim in education be reserved principally for industrial arts? The shop can help significantly, but there should be close correlation of the work in this area with all of the departments in the school.

The nature of industrial materials and processes is basic in the understanding of our machine age. This objective is recognized by teachers of science and much of the content of the course in general science relates to this end. Professional training in shopwork must help the student to recognize his obligations in seeking to correlate with the science department his endeavors in teaching youth in this important area.

Training for occupational competence in one or more fields of service is the basic aim in vocational education. This is the battleground for the experts in trade education and industrial arts. School superintendents and high school principals ask eagerly for help in deciding whether industrial arts should function in the area of trade training. Generalizations about the objective of occupational competence

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as a valid aim in secondary school shop programs do not suffice. There is a very real need for objective, disinterested thinking and action on this issue by competent authorities in both fields. A tentative frame of reference for such discussion and study may be summarized as follows:

1. What are the basic manipulative experiences in school shops which vocational schools would like to have given to their pupils before enrolling for trade training?
2. What are the definite areas of industrial information which every high school student should possess whether or not he or she continues in a vocational school?
3. What are the areas of training for later employment as semiskilled or unskilled workers in the many service areas which do not require trade education?
4. Following the war, how many industrial arts and vocational education programs be correlated most effectively for the majority of youth who will not be employed until the age of 18?

Many other proposals might be suggested for joint study. There is an urgent need, however, for intelligent, frank, constructive action. The professional status of both programs suffers because of the confusion and partisanship in the present impasse.

The industrial-arts students at the State Teachers College at Fitchburg, Mass., have been required to complete six semester hours of class and shopwork in the accepted vocational teacher-training courses conducted by the State Division of Vocational Education. Under this program these young men are helped to understand the work and the procedures in approved vocational schools. It is hoped to strengthen this setup by providing similar courses in industrial arts for trade school teachers.

Training in democratic living is tremendously important in these war years. The success of such efforts in school shops depends almost wholly on the point of view of the instructor. Unless he is committed wholeheartedly to the principles of justice, cooperation, freedom of expression, and the integrity of human personality, then no plan of shop organization can insure democratic living and sharing.

The training of girls in the problems of our industrial age is generally ignored in the secondary schools of New England. Adequate and efficient provision has been made in the field of home economics. But time limitations and a lack of understanding about industrial arts have thus far limited the enrollment of girls in school shops to a very, very small number.

The professional school for teachers of industrial arts recognizes the importance of furthering the study of objectives in this area. It seems desirable to clarify one or two areas and to seek agreement on a limited number of aims rather than to extend the list to such an extent as to becloud the main issues.

Industrial arts in the reorganized secondary school curriculum

Reference has been made to the several important national and regional surveys of secondary education during the past ten years. The yearbooks of the National Association of Secondary School Principals are replete with findings about the proposals for changes in junior and senior high school curriculums. The urgent need for providing a functional type of education for the majority of pupils enrolled in the so-called general course has been recognized. There are men who believe that the field of industrial arts provides a most helpful medium for a core curriculum for training youth for life and work. The industrial-arts teacher must know about these surveys and recommendations. The leaders in this field should establish a steering committee to work closely with the officers and committees of the National Association of Secondary School Principals. It is high time that the possible contributions of an enriched and integrated program of industrial arts be recognized.

Digest of problems confronting industrial-arts leaders in New England and their implications for teacher training

A. In small high schools with one shop teacher.

1. What are the basic work experiences in the daily life of the community which can be presented in the industrial-arts shops within the assigned time?
2. What are the graded objectives in a general shop for pupils in grades 10, 11, 12?
3. Should shop periods be reserved for manipulative experiences with the development of related studies in other periods?

B. In larger high schools with several shop teachers.

1. What plan of faculty organization will insure the most effective use for guidance purposes of the information which shop instructors can provide about the individual pupil's attendance and capacities?
2. What is the most efficient system of recording pupil accomplishment at several levels of shop practice?
3. What criteria determine the assignment to a particular shop and the most effective length of time to be spent in shopwork by different pupils?
4. What are the accepted levels of accomplishment for pupils in grades 10, 11, and 12 in the following fields:
   a) Unit shops (wood, metal, printing, drawing)
   b) General shops
   c) Auto mechanics
   d) Airplane construction
5. What is the most effective service of industrial arts in the new field of aeronautics?

The foregoing lists of problems are samples only of a long list of difficulties which can be solved only when the shop teacher and principal see eye to eye as to the possible contributions from industrial arts. The teacher-training program is inadequate at present because of a lack of general agreement on many such issues.

Industrial arts and the war effort

The importance of industrial-arts teacher training has been recognized officially by the following governmental agencies:

1. Selective Service
2. Army and Navy
3. Federal Civil Service

The acute shortage of industrial-arts teachers has reached the danger point as indicated in the closing of a number of school shops because the instructors have entered armed services. It is a shortsighted policy to deprive thousands of our youth of the opportunity of discovering in school shops whether or not they have native aptitude for serving in one of the many fields of mechanized warfare in the army, navy, marine corps, and coast guard. Competent shop instructors between the ages of thirty and forty can render a most important service to our 18- and 19-year-old youth by demonstrating in the shops that they have the skills which are so urgently needed in servicing aircraft and many types of armored vehicles.

The recognition given to trained industrial-arts teachers in the programs similar to work at Chanute Field is most heartening. We may confidently expect to gain in public esteem as the result of work of this type. Every senior high school industrial-arts teacher should be offering short-term courses for 16- and 17-year-old boys in the following fields:

1. Mechanical drawing and blueprint reading
2. Fundamentals of machine lathe and drill press work
3. Basic structural patterns in model airplanes made in the United States

These offerings are not only valuable for the war effort but provide a significant part of the program in the high school victory corps.

Summary of the philosophy of the industrial-arts department at the State Teachers College at Fitchburg

1. The shop teacher should be a well prepared, college trained member of the teaching profession.
2. The shop teacher should be well equipped with basal skills in the organization and conduct of the unit shop and the general shop.
3. The shop teacher should have a clear understanding of the basal objectives in general education, in vocational education, and in industrial arts.
4. The shop teacher must contribute to the development of a better understanding of his work among school teachers and superintendents, school committee members, and the taxpayers.

Training Replacements for Industrial-Arts Teachers

GORDON O. WILBUR*

As the needs of industry and the armed services continue to siphon off more and more industrial-arts teachers, the necessity for replacing them becomes an increasingly grave problem. Faced with the imminent closing of many shops, New York State has, for the past two years, made an effort to find an additional supply of teachers for the period of the emergency. The experience gained through this experiment may be helpful to others faced with similar problems.

Early in the school year 1941–42 plans were laid to give temporary certification to a group of men who would come to Oswego State Teachers College and complete an intensive two-week course. School superintendents and principals were advised of this decision and urged to find someone in their community whom they could send for this session. The result was that at the beginning of the third week in August, 1942, forty men and one woman reported to start the course.

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Fig. 2. Wood turning

Fig. 4. Testing electric current consumption

The subjects to be offered during this session were chosen on the assumption that most of those who were enrolled would already be well prepared in at least some field of tool skills. It had been expected that the group would be mainly carpenters, auto mechanics, and the like. The subjects chosen were, therefore, almost exclusively professional. They included one-hour classes in industrial-arts methods, professional relationships, teacher-pupil relationships, and shop demonstrations. Two hours per day were devoted to lesson planning and teaching, and two hours to project planning. This, then, made up the eight-hour day, and it was planned to operate six days a week for two weeks.

An analysis of the background of those who enrolled soon indicated, however, that the situation had been misjudged. In addition to tradesmen the group also included ministers, farmers, and a number of teachers from other fields. Only about half of the group had satisfactory technical preparation in even a single field. This deficiency was apparent not only to those who had charge of the program, but to members of the class also. The demand was voiced, therefore, that some actual shopwork be offered. Inasmuch as the program had been prepared well in advance, and faculty chosen on the basis of their ability to teach the professional subjects, it was impossible to make a complete change in the type of work to be offered.

Fig. 3. Wood finishing

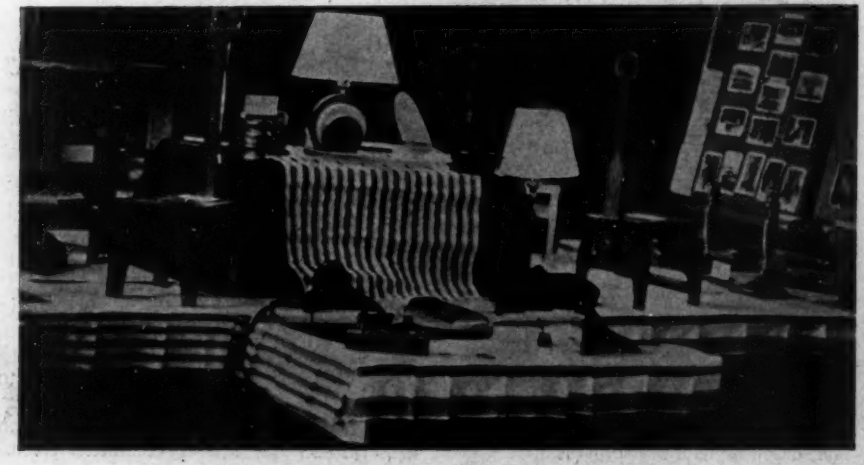


Fig. 1. A group of woodworking projects

Fig. 5. Electroplating

Fig. 6. Coil winding

Fig. 7. Testing a small electric motor

Fig. 8. Learning how to make a mold

Plans were made, however, to open the shops during the evenings, and allow those who so desired to work in the field of their choice. In spite of the fact that they had already spent an eight-hour day in class, attendance at these evening offerings was almost one hundred per cent.

Of the 41 who enrolled, 38 completed the course. The other three individuals decided they were not suited for the work. All but two of those who finished either had positions when they started the course or had been appointed before the end of the two-week period.

It has been difficult to evaluate accurately the success of the 1942 program. What evidence there is, however, seems to indicate that most of those who attended succeeded in carrying on an acceptable industrial-arts program. It was possible to visit a number of these men at work, and in every case the supervisor was satisfied with what was being accomplished.

On the basis of the apparent success of the first venture, a similar course was planned for 1943. In spite of the growing man-power shortage the first day found an enrollment of fifty men and three women. The group included nine who could be classified as carpenters or contractors, eight teachers of agriculture, six vocational teachers, six machinists, four elementary teachers, three teachers of mathematics, three social studies teachers, two principals, two music teachers, one art teacher, one custodian, one industrial-arts teacher (refresher), one minister, one sheet-metal worker, one printer, one salesman, one auto mechanic, one language teacher, and one housewife. Fifty-two of these are now teaching industrial arts.

The program offered this year was almost the complete reverse of that followed in 1942. No professional courses (as such) were offered. Instead, three shops, woodworking, metal, and electricity, were planned. Each person elected two of the three and spent four hours a day in each. Methods of teaching, shop organization, and the like, were taught by the shop teachers as a part of their work. The reactions from the students lead to the belief that this type of organization came much nearer to meeting the real needs of the group than was the case last year.

In the woodworking shop, the major part of the time was spent in making several simple projects that could be used in junior or senior high school classes. Figure 1 shows a group of these projects as they were exhibited near the end of the session. Emphasis was placed on the planning of these projects, and on learning the basic tool processes. Some opportunity was given for work in wood turning. How an erstwhile agricultural teacher gains an appreciation of design and proportion as applied to wood turning is shown in Figure 2. Simple wood finishing was experienced by all, and Figure 3 shows how a social studies teacher learns the meaning and importance of a good finish. In addition each member of the class was required to prepare and give a demonstration of some tool process. Technique and method were then constructively criticized by the class.

Due to the nature of the subject, more

Fig. 12. Learning to use the engine lathe

Fig. 9. Pouring the mold

Fig. 10. Forming a scroll

Fig. 11. Decorating metal by chasing

time in electricity was spent in a discussion of theory and principles. Sufficient time was reserved, however, for experimentation. Figure 4 shows two former vocational teachers checking on the amount of current consumed by various electrical devices, while Figure 5 indicates how one of the men learned about the process of electroplating. Many electrical devices and projects were also made. In Figure 6, a machinist is shown winding a coil for an electromagnet, while Figure 7 shows a testing process in the construction of a small electric motor.

Experiences in metalworking covered a wide variety of activities. Figure 8 indicates how a minister learns that metal may be shaped by pouring it into prepared molds, and Figure 9 shows how experience in the melting, handling, and pouring of metal was acquired. Methods of cold-metal working were also taught. Figure 10 shows an agricultural teacher learning how to form an attractive scroll by use of the bending jig. The artistic treatment of metal was further emphasized through the making of art-metal projects. A former carpenter is shown in Figure 11 learning how to use chasing tools as a means of surface decoration. Working to accurate measurements was also stressed. How this was accomplished is indicated in Figure 12, which shows a building contractor learning to use the engine lathe. The process of forging was another activity in which all participated. In Figure 13 a teacher of agriculture is learning the fine points of hot-metal working.

Fig. 13. Forging practice

From five to seven metal projects were made by each person. Important instruction in project planning, teaching methods, materials, and techniques was also presented.

A new experiment this year consisted of two evening classes each week in blackboard sketching. While attendance at these sessions was voluntary, almost every person was on hand for each class. The unusual growth in ability shown by the group between the first and last sessions seems to indicate the need for this type of experience.

Those who have been closely associated with the planning and administration of these courses feel that, while far from perfect, they represent a partial answer to the problems of wartime shortage of industrial-arts teachers. The number of teachers to be taken into the armed forces and war industries is probably near its maximum. Therefore, if enough suitable candidates can be recruited and trained in short intensive courses such as those described, it appears possible to hold the supply of instructors near its present level.

Shipyard Develops New Training Idea

SAM LeCOUNT*

The Moore Dry Dock Company, Oakland, Calif., has recently developed a new idea in training marine electricians. Under the leadership of a committee of company foremen, a "Home Study Course for Marine Electricians" was written. One chapter of this course, each week, is given to every trainee. A question sheet on the last page of the chapter must be answered by the trainee and returned to the training department. At the completion of the course the trainee is given a thorough examination by an electrician instructor, after which he receives his journeyman's rate and may then carry on independent work. Over seven hundred trainees are now enrolled in the project at Moore's.

The keyman in this type of on-the-job vocational training is the job instructor. He demonstrates to the trainee the practical application of the facts obtained from the home study chapters. The job instructor teaches as he works; the trainee learns as he produces.

*Training Supervisor, Electrical Department, Moore Dry Dock Co., Oakland, Calif.

The first 19 chapters of the home study course are elementary and cover only those job operations most likely to be assigned to a trainee. There are five concluding chapters in each of the four fields of marine electrical specialization: power, lighting, interior communications, and maintenance. The trainee selects the field for study according to the field in which he is working. These concluding chapters are more advanced than the first 19 and include information on blueprint reading and layout work. Identical copies of blueprints of relatively easy jobs form part of the material which the trainee studies.

American war industries are making a valuable contribution to vocational education through the development of efficient on-the-job training programs. Hundreds of electricians now performing vital services for the military and naval forces received their initial training in the shipyards. The shortage of electricians would be far more serious were it not for the shipyard vocational training programs.

Vocational educators look for a continuation after the war of this type of industrial training when the nation is converting to peacetime industries and is developing new lines of production.

Some teachers employ the same means with every subject, phase, class, and boy with which they deal. Their plans and actions are the same for every day and period. One would expect them to fish in any water and at any time of day with the same bait, depth, and action, but they know better than that. They are not content, *in their fishing*, to work without matching of method and aim and to take what they chance to get. They want to be happy on the way home and when they meet their discerning friends. Those who teach by a single method should have their stories and their strings of catch well examined. —*Homer J. Smith.*

Buy what thou hast no need of, and ere long thou shalt sell thy necessaries. —*Benjamin Franklin.*

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

John J. Metz, Editor

Those Precious Cutting Tools

With the millions of warworkers now engaged in the industrial shops of this country, producing guns, tanks, and planes, the consumption of cutting tools assumes gigantic proportions.

Even in normal times, when most of the tools are in the hands of thoroughly skilled mechanics, the preventable loss of cutting tools is quite large. It is much more so now, where comparatively unskilled workers, who have not as yet fathomed the delicacy of a fine cutting edge, or the ease with which the value of a cutting tool may be destroyed, are employed in our industries in numbers that stagger the imagination.

When one considers how difficult it is to obtain the proper tools and tool steels under present conditions, and when one takes into account how lack of cutting tools will affect war production, the real value of these cutting tools really becomes apparent.

The problem that confronts the industrial world is how to get the idea of tool conservation across to their workmen. Evidently it is an educational task in which industry and the schools must work together. Both the experienced mechanic and the hurriedly trained specialist must be impressed with the fact that tools are at present consumable implements of war. Without them, production of needed war supplies and equipment will be curtailed. This must not happen under any circumstance, hence all workers must be consciously impressed with the necessity that tools must be handled with utmost care.

These workers must be taught that it is expedient to change tools before they get too dull, to avoid striking or even laying cutting edges on metal surfaces, and to put away cutting tools carefully so that moisture will not destroy their efficiency.

The school shop can be of great assistance in all of this. Start impressing the student with the value of all tools when he comes to the school shop for the first time, and by the time he enters industry he will have a thorough appreciation of the value of a good cutting tool.

Discipline in the School Shop

When the question of shop discipline is discussed, many teachers will at once think of various methods in which punishment is or may be meted out to recalcitrant students, and if the discussion is allowed to continue without check, one can learn of many odd and eccentric schemes that have been employed in chastising the refractory student who has defied the constituted authority by breaking a law set up by the teacher.

A glance at Webster's dictionary will show, however, that the word *discipline* has a number of different meanings and that the one pertaining to the punishment aspect of the word is by no means the first definition given. It is interesting to note, and a point that ought never to be forgotten by teachers, that Webster's first definition of the word refers to one that unfortunately is now obsolete; namely, that discipline means teaching or instructing. Other definitions of the word are: "that which is taught to pupils; training which corrects, molds, strengthens, or perfects."

Probably it would be well for those of us in the field of teaching to give this word a very broad interpretation and to apply all of the meanings which Webster has given to it.

If that is done, discipline will become a positive rather than a negative force in our school shops. Discipline then will be a forward looking, uplifting phase of our teacher-student relationships which will vitally and consciously affect the character development of our students. Discipline administered in this way will have a guiding rather than a punitive influence, thus fitting much better into our modern idea of bringing more democracy into our classrooms.

Of course, discipline, to be applied in this way, is a carefully planned process — not something which is haphazardly brought into action by a misdeed. Furthermore, such discipline must follow a flexible plan which can be adapted to the individual member of the class as well as to the class as a whole.

Individual differences must be recognized in the disciplinary phases just as they must in other aspects of the educative process, and the transition from the application of the older concept of discipline to the newer, in a given class, must be made gradually in order that the students may have ample opportunity to adjust themselves so they may do their part in bringing about a more worth-while application of the disciplinary idea in the school workshop.

Let's Change This Bad Habit

Attendance at many conventions where shop teachers congregate can but impress one with the innate modesty which seems part of the make-up of most shop teachers. Enter any room or hall in which a shop teachers' meeting is to be held and you will be able to observe how religiously these teachers observe the biblical injunction, "But when thou art invited, go, sit down in the lowest place. . . ." They show both humility and modesty, but their reluctance at coming to the front, or shall we call them "the seats higher up," is not only disconcerting to the speaker but actually troublesome.

Of course, in these days of loud-speaker systems, those seated in the rear seats can hear the speakers practically as well as can those in the front rows. As a matter of fact, they could hear as well if they were in an adjoining room served by the same loud-speaker. In that event, the speaker and the audience would not have to look at each other at all. Probably neither speaker nor hearer would enjoy a lecture given in this way.

Why, then, should teachers who ordinarily are so ready to do the gentlemanly act be so discourteous as to offer a real affront to the men who have come, some from far distances, to address them. No doubt, there is no intention to offer an insult, nevertheless a little reflection shows that speakers cannot be blamed if they look upon such actions as being far from thoughtful or polite.

Most speakers actually resent it when their audience wants to spread out over a large hall without occupying the seats nearest to the platform. Most speakers, too, will make an appeal to those in the rear seats to come forward. When that happens, it usually takes considerable time before anyone does come forward.

Thoughtlessness, sheer thoughtlessness. Now that the annual convention time is again with us, let us try to do better. It is high time that we learn to treat those who come to share their knowledge with us as courteously as their kindness and willingness deserves.

The General Shop After the War

R. T. CRAIGO*

The impact of the war on the entire field of education will without question have an important bearing on instructional content and instructional methods. This is evidenced by the many articles appearing in magazines and newspapers and further reflected in meetings and conferences of those interested in directing both the general education and the vocational education movement throughout the country.

Many engaged in industrial arts and vocational training believe that the general shop which has been an increasingly important factor will stand out even more prominently as one of the devices to help both young and older men to prepare more efficiently for their life's work.

The general shop has been in operation at Dunwoody for many years. It was first introduced following World War I at which time Dunwoody Institute trained large numbers of returned disabled servicemen. At the same time it was training students without military service, both novices and experienced men.

Many years' experience has resulted in the general shop procedure as carried on at Dunwoody which may be of interest to those planning ahead in more efficiently carrying on industrial arts and vocational training.

The 12 main departments fed by students from the general shop are: air conditioning, automobile, baking, building construction, drafting, electricity, general mechanics, highway construction, machine shop, printing, sheet metal, and welding.

Time element: Students remain in general shops from one week to many weeks.

Most of the main departments operate 18 months, including the time spent in general shops.

The following objectives have been set up for the general shop: testing, review, trade tryout, advisement, reservoir, skills, orientation, related trades, readvisement, and checkup on trade experience.

Testing: Inasmuch as Dunwoody Institute admits students from 16 to 60 years of age, with previous schooling varying from eighth grade to college graduates and with trade experience varying from 0 to 20 years, it is necessary to establish a testing-review-retesting program.

Review: Because many incoming students are deficient in, or have become *rusty* in certain fundamental subjects, it is necessary that review periods be established.

Trade tryout: Since a large number of younger students entering Dunwoody either do not know the trade they wish to follow, or have a choice between two or three separate trades, or wish to select not only the trade but its subdivision (i.e., electricity — radio, or electricity — telephone), it has been necessary to carry on so-called *baptismal* or tryout instruction.

Advisement: The advisement program is really a corollary of the tryout program.

Reservoir: New students enter Dunwoody on the first of any month and frequently almost any day of the school month. For this reason it is necessary to set up a reservoir into which new students may be scheduled, awaiting their turn in regular training programs.

Skills: The main departments have asked that beginning students, especially the younger students, be given an opportunity to acquire certain fundamental or basic skills. This can best be done in a general shop setup.

Orientation: Inasmuch as many students coming to Dunwoody are *out of step* with the vocational training program, there is a need for a so-called *orientation program*, which would prepare the students for the main departments and which may be considered as an orientation or vestibule training program.

Related trades: Students in a training program are constantly in need of trade knowledge and trade skill of the kind that might be termed *related trades*. Thus, the automobile mechanic must know something about the electrical trades, and the machinist is frequently called upon to know something about electric power and machine work as applied to automobiles.

Readvisement: In a complete trade training program it has been found necessary to set up a readvisement procedure for the student who has failed to progress in his selected trade or who for various reasons may wish to be *readvised* relative to entry into another line. These cases are returned to the general shop for such readvisement.

Checkup on trade experience: A fair number of applicants who claim trade experience, say in the automotive line, need to have a checkup made of their claims. Thus, the applicant who claims two years of automotive trade experience previous to enrollment may have actually spent most of his time in sales work or in lubrication and is, in reality, not prepared for trade extension automobile training at all.

Procedures

1. Practically all students entering Dunwoody Institute come in through the *vestibule* of the general shop.
2. They remain in the general shop all the way from a day or two, as a minimum, to four or five months as a maximum.
3. A flexible program is set up but in general the students are scheduled half day in shop and half day in class. The half day in class is split half (25 per cent of the day) for general subjects, and half (25 per cent of the day) for related subjects.
4. Students needing special review work may be scheduled to attend class all day, while those with previous trade experience may be scheduled to attend shop all day. Other distributions of time schedules are frequently worked out.
5. Younger students who will probably remain three or four months are scheduled the first month in their selected trade; the second month in a related trade; and the third month they may be continued in a related trade or returned to the trade they selected.
6. The staff schedule, program, and setup facilitates considerable checkup, review, advisement, and *filling up holes* in their foundation.
7. Discipline cases, handling of students who are "too much job minded and too little school minded," attendance problems, and many other cases coming under the classification of personnel or student management are largely handled in the general shop period.
8. In a fair number of cases students are transferred from general shop to main shop on a sort of probation program, frequently returning to the general shop for further advisement.

Organization

The general shop includes the following specific activities: automobile department, machine shop, electrical department, mechanical drafting, sheet metal, blacksmithing, and general mechanics (including gas engines, Diesel engines, tractors, farm lighting, auto electric, and electric signal equipment).

Inasmuch as specific subdepartments are not set up for printing, building construction, highway, and air conditioning, the

*William Hood Dunwoody Industrial Institute, Minneapolis, Minn.

main department shops are utilized for these lines.

The staff of the general shop must possess considerable flexibility due to the fact that in the early fall and again following the beginning of the new calendar year, very large incoming groups call for a very heavy staff. Later on, as the groups of students are transferred or promoted to main shops, part of the staff used in the general shop travels along with the transferred student groups.

Experience has also proved that the general shop is an excellent department to serve as a training center for the call staff and student assistants used not only in the general shop, but later on in main shop departments.

SKIDDING SEASON HERE

The skid season is upon motorists and it should be remembered that cars can't be stopped quickly on slippery roads.

When motorists jam on their brakes and lock the wheels they lose steering control and the car goes into a skid.

Careful motorists will drive at low speeds to avoid the necessity of making sudden stops or quick turns on slippery roads. To slow down or stop, it is wise to leave the car in gear and apply the brakes cautiously and intermittently.

Unless motorists operate their cars at safety slow speeds and drive cautiously, no amount of skill will prevent a skid.

THE CARPENTER

G. A. Studdert–Kennedy
(1883–1929)

I wonder what He charged for chairs at Nazareth,
And did men try to beat Him down
And boast about it in the town —
"I bought it cheap for half a crown
From that mad Carpenter"?

And did they promise and not pay,
Put it off to another day;
Oh, did they break His heart that way,
My Lord, the Carpenter?

I wonder did He have bad debts,
And did He know my fears and frets?
The gospel writer here forgets
To tell about the Carpenter.

But that's just what I want to know.
Ah! Christ in glory, here below
Men cheat and lie to one another so;
It's hard to be a carpenter.

— *Selected*

Without being robbed of its make-and-mend, observe-and-attempt character, the subject (industrial arts) has come to be, in a host of communities, a veritable mine of the thoughts and feelings most beneficial in a life. Industrial arts owes its easy, quiet acceptance and respect by the general public more to the increase of the information imparted than to the perfection of its process-and-product work. — *Homer J. Smith.*

We must not in the course of public life expect *immediate* approbation and *immediate* grateful acknowledgment of our services. But let us persevere through abuse and even injury. The internal satisfaction of a good conscience is always present, and time will do us justice in the minds of the people, even of those at present the most prejudiced against us. — *Benjamin Franklin.*

Problems and Projects

READING A 36-DIGIT NUMBER

MICHAEL W. ZEHEL, PRIN.
Republican School
California, Pa.

In these days when large numbers are commonplace it may stimulate class interest to learn how a 36-digit number may be read. The number shown herewith is read thus: five hundred sixty-eight decillion, seven hundred ninety-two nonillion, three hundred fifty-six octillion, seven hundred fifty-nine septillion, three hundred forty-six sextillion, three hundred twenty-five quintillion, eight hundred seventy-four quadrillion, six hundred thirteen trillion, seven hundred forty-two billion, six hundred thirty-six million, six hundred fifty-four thousand, three hundred twenty-one.

Reading a 36-digit number

READING NOMOGRAPHS OR ALIGNMENT CHARTS

GIFFORD N. MAST
Detroit, Mich.

Figures 1 and 2 show two types of nomograph readers in use. The nomograph reader is a special rule to simplify and speed calculation with nomographs, or alignment charts, as they are frequently called.

Nomographs are calculating devices much used in engineering and mathematical work to solve particular equations easily and directly, and with a very limited number of operations. The two shown were designed for use in the complex calculations called for by a Navy project under way at the Jam Handy Corporation.

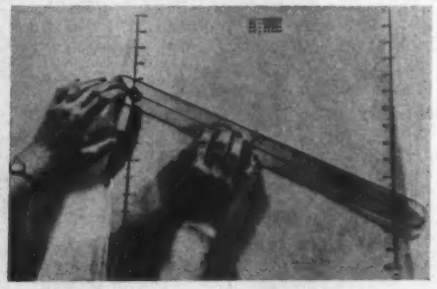


Fig. 1. Single pivot nomogram reader

The nomograph reader, which may be produced inexpensively, is made from 3/32-in. flexiglas and in its simplest form has a single transparent pivot with cross hairs as shown in Figure 1. It may also have a sliding pivot, as does the reader shown in Figures 2 and 3.

The simplest and most common type of nomograph is a chart solving an equation in three variables, the values of any one of which may be read from it if the other two are known. It consists of three scales, each one bearing the desired range of values of the variable it represents.

The usual method of reading such a nomograph is to place a ruler against the known value of the first variable, rotate it until it crosses the known value of the second variable, and read the desired answer where the ruler crosses the third scale. However, in lining up the ruler with the second scale setting, it generally becomes displaced from the first one, so that several adjustments have to be made before an accurate reading can be taken.

For use with this type of nomograph, the simple form of the monograph reader having only one pivot is used. The cross hairs of the

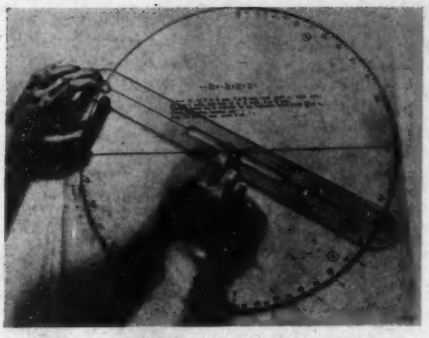


Fig. 2. Nomogram reader with both fixed and sliding pivot

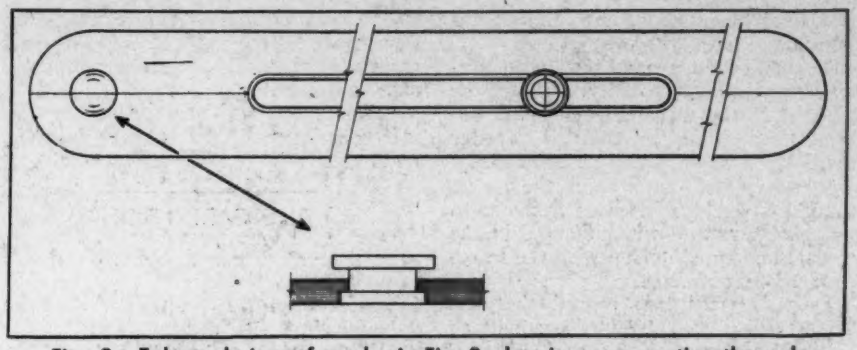


Fig. 3. Enlarged view of reader in Fig. 2, showing cross section through the fixed pivot

pivot are set on the known value of the first variable and a finger placed firmly on the pivot. The rule may then be rotated freely until its index line lies on the known value of the second variable without any chance of displacing the rule from its first setting. The answer is then read where the index line crosses the third scale.

The transparent pivot makes it possible to accurately locate the first setting and maintain it while making the second. The index line permits more accurate reading and interpolation than does a ruler, because there is no obstacle to vision. Parallax is eliminated by having the index line etched on the lower surface of the plexiglas rule.

The nomographs shown in Figures 1 and 2 were drawn on plasticele instead of on graph paper. This was done because plasticele is undistorted by humidity, withstands hard usage, and does not mark or soil easily. If soiled, it can be cleaned with a moist cloth. To prevent abrasion of the scales, they are inked on the reverse side. To facilitate laying the scales out in pencil and inking them, sheets with one frosted side are used.

Equations with more than two known variables require for their solutions the use of *multiple* nomographs, necessitating several settings of the rule, and often the marking of a point on a blank scale. Such a nomograph is shown in Figure 2. The old method of using such a nomograph is to set the rule on the first two known values, make a mark on the center scale, and then swing the rule to align it with this mark and the third known value. The desired answer is then read where the rule crosses the fifth scale. The blank scale is soon cluttered with marks, or if the more durable plasticele chart is used, is not readily marked with a pencil.

This nomograph reader with both fixed pivot and sliding pivot does away with most of the usual difficulties. The fixed pivot is used in the manner described before, but instead of marking the blank scale, the sliding pivot is placed on it and held there while the rule is rotated to the third known value. The desired answer may then be read where the index line crosses the scale of the unknown.

For other special kinds of nomographs, modifications of the two forms of the nomograph reader described may be required. It has been found through actual use for thousands of calculations in our mathematics department that the nomograph reader aids materially in obtaining speed and accuracy in calculation.

LATHE CUTTER BITS FROM THE SCRAP HEAP

J. HENRY SCHROEDER

Head, Industrial Education Dept.
Southern Illinois Normal University
Carbondale, Ill.

Sometime ago when it became evident that schools could not obtain enough regular cutter bits to keep their students supplied, I began experimenting with various substitutes and makeshifts. The problem was to find something around the shop that could be used, which would otherwise be wasted.

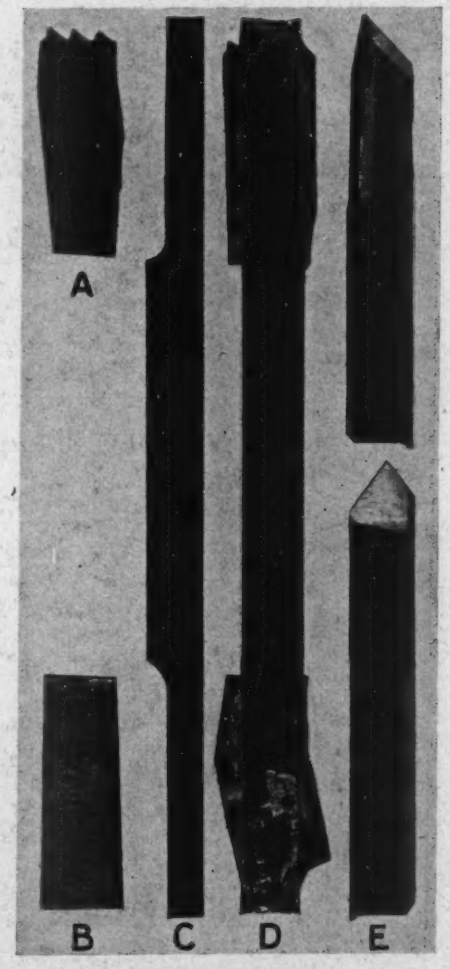
I found that the power hack-saw blades that we had been using were about 1/16 in. thick and were made of high speed steel which remained hard after heating to red heat. A considerable number of these blades which were no longer good enough to use in the hack saw had been saved, thinking that some use might eventually be found for them. If you do not have such material around your school shop it is very likely that you can find some wornout or broken blades at a local machine shop, garage, welding, or other repair shop. Most mechanics throw these blades away when worn out or broken and will be glad to give them to you.

These blades were then broken into pieces about 3/8 by 1 in. The width of the blade is about 1 in., so I broke the blades crosswise. To do this at all well it was necessary to score the blade rather heavily where it is to be broken. This scoring may be done on the edge of a high speed grinding wheel. After they were scored they were put in a vise and given a sharp blow with a hammer.

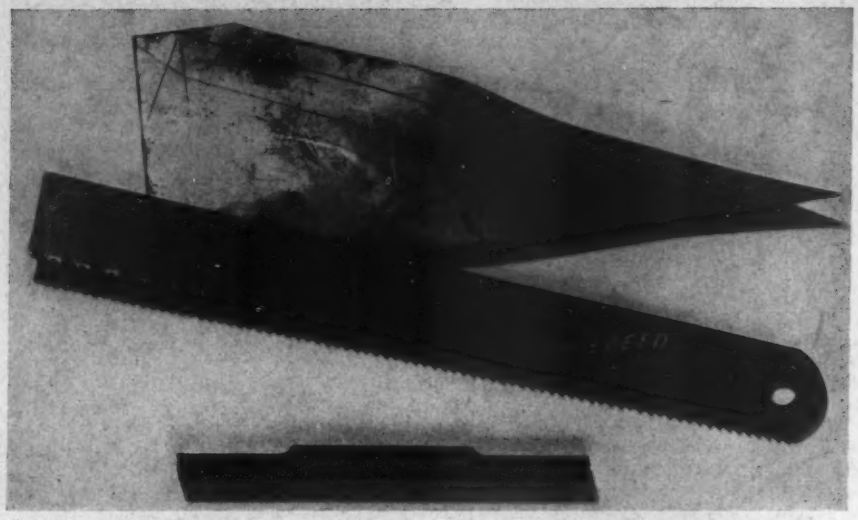
The body of the cutter was made from a piece of mild steel. A recess was cut into one end of this piece deep enough, that when the piece of saw blade was brazed to the mild steel bar the top surface was flat and even.

The brazing of the saw steel to the mild steel body was for a time a difficult problem but after a little practice it became very easy. First I cut a piece of thin sheet brass about the same size as the saw steel. This brass piece was placed on the mild steel body with brazing flux sprinkled under and on top of it. The saw steel was then placed on top of the brass and held in place by a steel rod held with the left hand, while the heat was applied with an oxyacetylene torch held in the right hand. As soon as the brass had completely melted the torch was removed and the steel allowed to cool while the parts were still held in place with the steel rod in the left hand.

The cutter bit was then ready to be ground to the shape desired. Remember that this cutter has but a thin piece of hard steel on



A — The saw steel
B — The brass
C — The tool stock
D — The brazed stock
E — The finished bits



The scrap from which good cutter bits can be made

the top surface of one end and only the minimum amount of grinding is possible on the top surface.

Such cutters have been in use in our shop for nearly a year and have proved to be very serviceable. Of course, when good high speed steel cutters are again available, we will be very happy to use them again. In the meantime we shall carry on with what we have or with what we can improvise, and be thankful for the stimulus which such difficulties provide.

P. T. BOAT OR MOSQUITO BOAT

JAMES MC GREGOR

Pasadena, Calif.

That the mosquito boat exists is well known to boys in school. Few civilians have ever seen one, but many know or at least can imagine the terrific speed and the deadly blows it can send out. Never before in all history has there been a boat of war with such moving force, to plough through the seas like fury, buzz, and be off. Is it any wonder then that boys in school ask for models they can build?

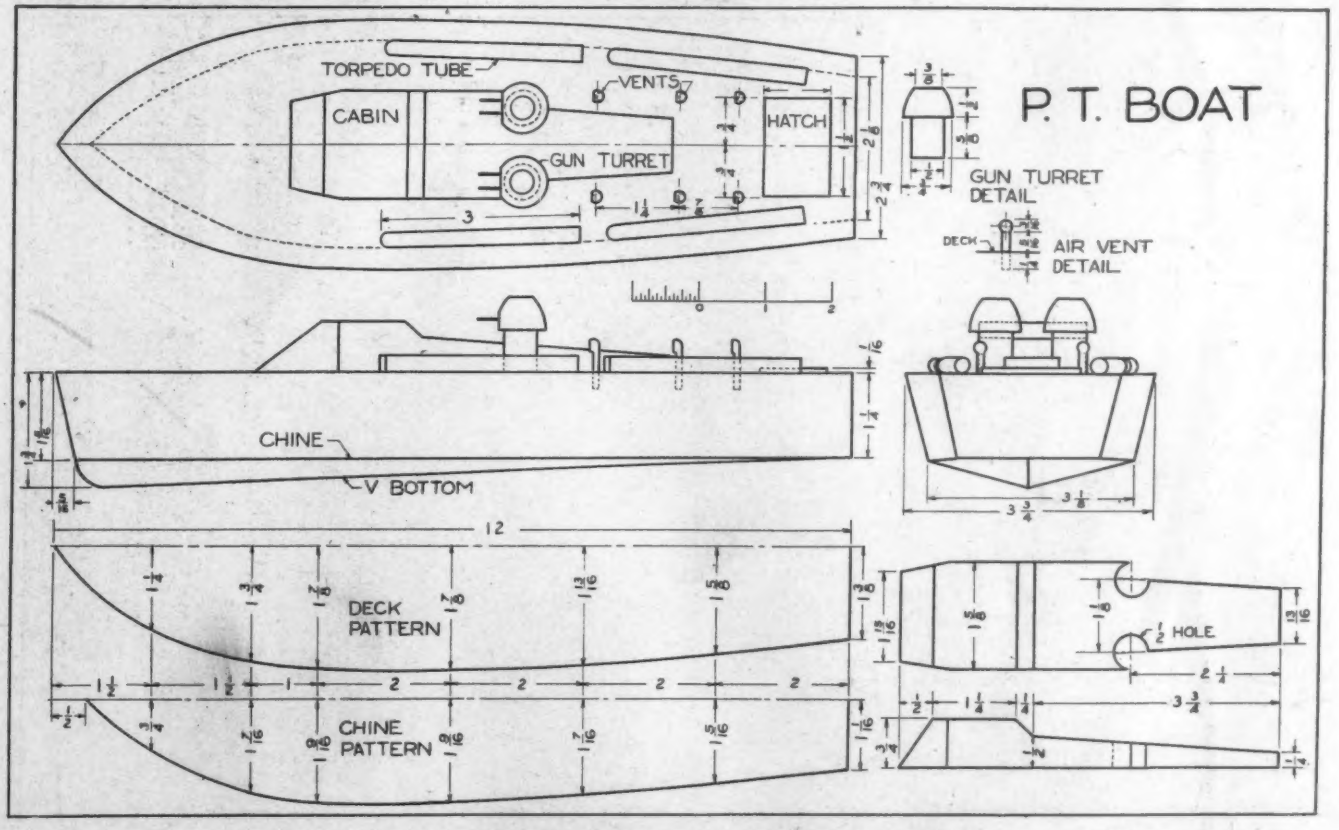
Patterns. These do not take long to make and aid in acquiring accuracy. Three are required, one each for deck, chine line, and cabin.

Hull. As many details have been added as would come within the ability of junior high school boys. More might be added but these would be of a minute character, and there seems no need to get lost in too much detail, and consume valuable time.

The first step is to cut the surfaced block to 12 in. long, and mark a line 1¼ in. across the stern parallel to deck. Taper the bottom of the block from 1¾ in. at the bow to this 1¼ in. line at the stern. The center line should be marked along the deck from bow to stern, along the bottom, and down both bow and stern ends. The deck pattern is then laid out on the top, and chine pattern on the bottom. Next join the points located while making the top and chine layouts at the stern, both on the deck and the bottom. This will give the true shape of the stern end of the boat.

The waste wood may be removed either by hand or with a jig or a band saw, being careful not to remove the deck and chine lines. Sloping the sides of the boat from deck to chine lines should be carefully done, leaving the lines just showing and no more. The sides when finished are perfectly flat.

To get the V bottom, mark the chine line on both sides of the boat. This may be measured or drawn with a thumb gauge. Notice that the V does not run all the length



Project submitted by James McGregor, Pasadena, Calif.

of the bottom, but that the stern is flat on underside. Forming of V may be done easily with plane and spokeshave.

To finish the bow note that there are no flares or concave lines at this point. In the actual P. T. boat there are concave lines at the bow, but these take considerable time to form, and have been omitted for simplicity. Therefore, all the finishing that has now to be done at the bow is to round off from the chine line to the V bottom.

If desired, the hull may be hollowed out and a deck put on. This is not essential unless the model is to be sailed.

Cabin. The holes in this can be jig-sawed, but if bored a better job is attained, and with less effort. To achieve this it will be necessary to mark the pattern on a piece of wood large enough to allow room for the bit when boring, and boring these ½-in. holes before cutting off the waste wood on the sides. A power jig saw can easily cut the sloping part of the cabin at aft end, but if this is not available a hand rip will do the job.

BILL OF MATERIAL

No. Required	*Name*	*Material*	*Size*
1	Hull S.2.S.	Sugar pine	1¾ x 4 x 12
1	Cabin S.2.S.	Sugar pine	¾ x 2¼ x 6½
1	Torpedo tubes	Dowel	¼ x ¼ x 12
1	Gun turrets	Dowel	½ x ½ x 2
1	Gun turrets	Soft pine	¾ x ¾ x 6
1	Vents	Soft pine	3/16 x 3/16 x 9
1	Hatch	Soft pine	1/16 x 1 x 1½

Gun Turrets. These are each made in two pieces. The bottom half, simply a ½-in. dowel, and the top half made from a piece of soft pine. In making the dome of the turrets, a piece of wood long enough to hold on to with one hand should be used. By doing this the dome may be formed very easily, first by shaping the wood like a dowel to ¾-in. diameter. The dome shape is then made on one end of this dowel, mostly with a cabinet file. When this has been done, the dome is cut off to length. Airplane glue is a good adhesive to use in the assembly of the turrets. The guns are 1-in. brads with the heads cut off, and since splitting may happen if care is not taken, holes should be bored with a small brad fastened in a hand drill to avoid this.

Vents. Again select a piece of wood long enough to hold on to with the hand, and round to 3/16-in. diameter, which is the size of the vent at top end. The stem or shank of the vent is filed down to ⅛-in. diameter, allowing ¼-in. extra length to fit into the deck of the boat. All forming and finishing of each vent is done before it is cut to length.

Torpedo Tubes. These are made of ¼-in. dowels, and each one is rounded on one end. Fastening is done with light brads through holes previously bored in the tubes.

Painting. Battleship gray, just one color, will solve the painting problem.

SHEET-METAL JIG FOR AIRCRAFT RIVETING

HARRY KERWIN

San Luis Obispo, Calif.

Shortened training time and greater proficiency in the skills taught are the shop teacher's watchwords. With the ever increasing demand for skilled labor and the terrifically short time in which to train, it is necessary to adopt any training method that will increase proficiency in a minimum length of training time.

The sheet-metal instructor in the war-production training classes at San Luis Obispo designed an ingenious sheet-metal jig which was built by the war-production welding class.

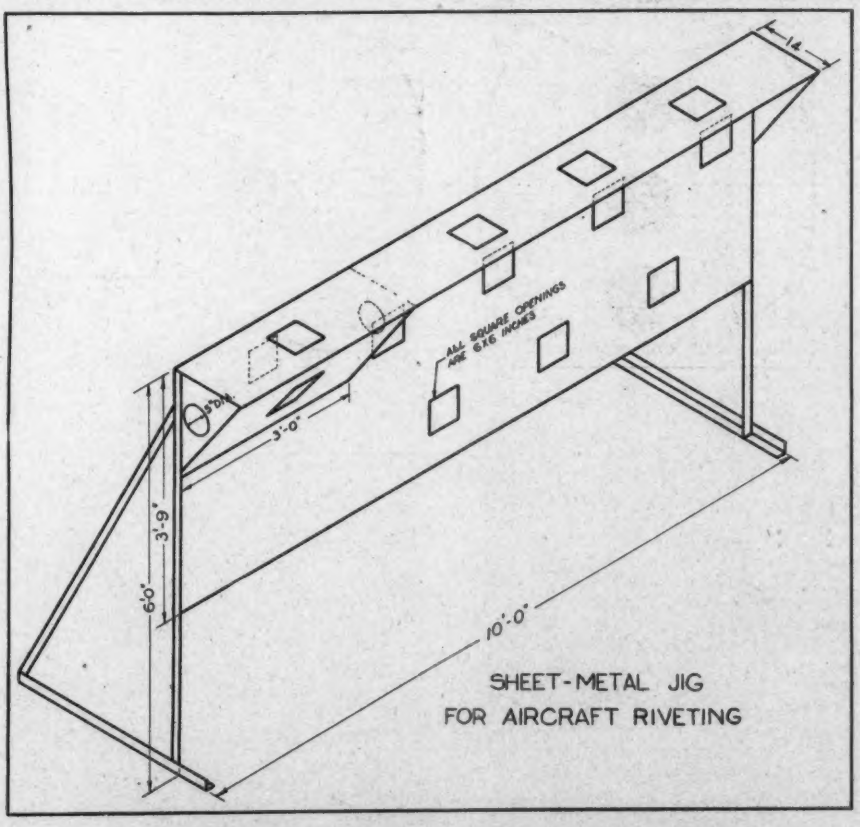
The purpose of this jig is to approximate the positions for doing overhead, flat, blind, left-, and right-hand riveting, when one and two men do the riveting. It also simulates the working positions encountered on a plane. As many as 12 students work at this jig simultaneously, learning to work in close proximity to each other while riveting.

The framework of this jig is fabricated from 1½ by 1½ by ⅛-in. angle iron, which is all arc welded. The body of the jig is 10-gauge black iron. This is tacked into the angle iron by arc welding. A ⅛-in. electrode was used to do the tacking and each tack is ½ in. long and spaced about 6 in. apart. This is sufficient to hold the sheet in place, and also minimizes the possibility of distortion which ordinarily occurs when long welds are made upon one side of a piece of metal.

As may be seen in the illustration, the openings are 6 in. square and purposely offset in the sheet and end plate to present difficult riveting positions.

Practice plates about 7 in. square are bolted over each opening by means of two ¼-in. stove bolts in opposite corners of the openings. This facilitates removal and replacement of practice plates.

It is readily seen that the students who have learned drilling and riveting on this jig will be more adept and further advanced than the students who have practiced only on small plates held in a vise.



Project submitted by Harry Kerwin, San Luis Obispo, Calif.

JUMPING JACK

HAROLD O. AKESON

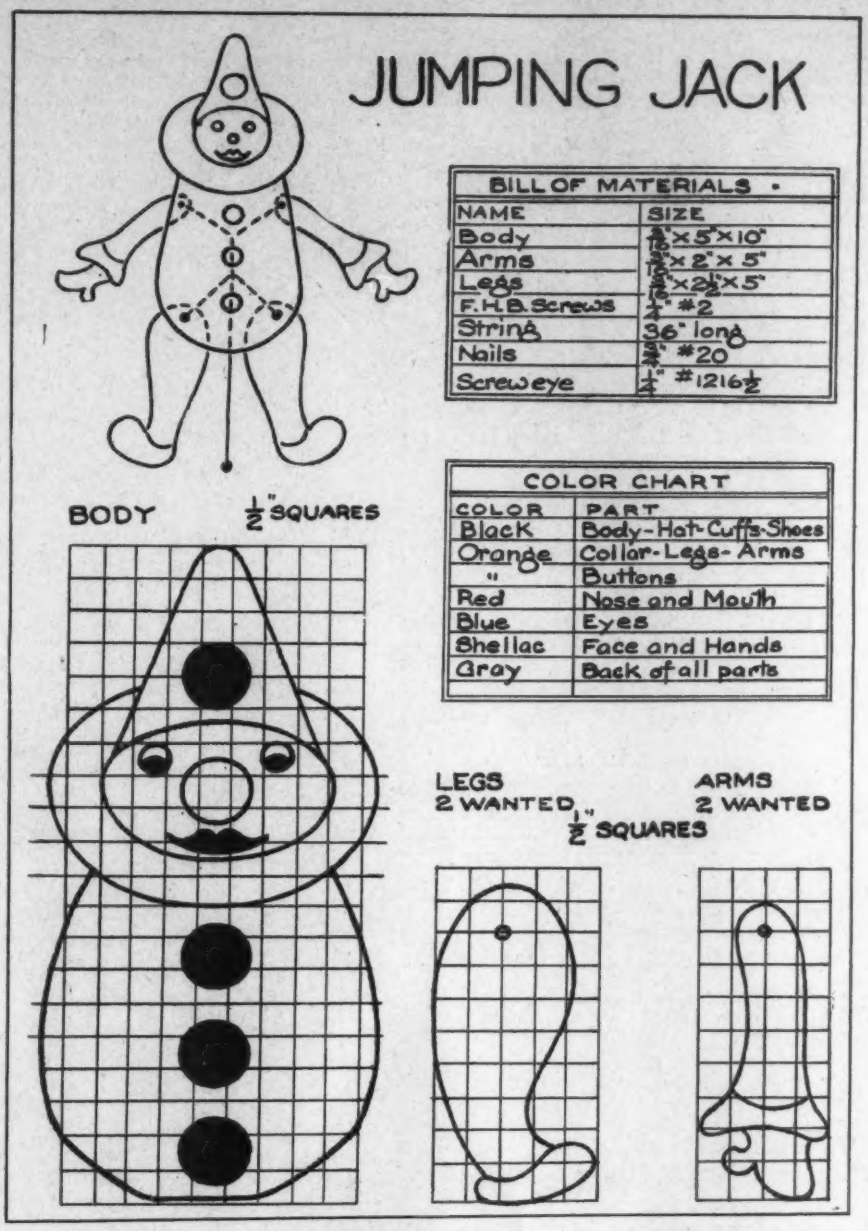
High School

East Orange, N. J.

The jumping jack has been a popular toy for small boys and girls for a great many years. Both in Europe and America it was the product of the kitchen workshop, with the jackknife as the essential tool. Usually it was made of pine from a wooden box obtained at the corner grocery store. A little paint and string completed the job.

Now that the war has curtailed certain materials used for making toys, many old-time wooden ones have been revived and are proving just as interesting as they were of old.

Any softwood, preferably pine or whitewood, may be used for making the jumping


JUMPING JACK
BILL OF MATERIALS
NAME | SIZE
Body | 3/16" x 5" x 10"
Arms | 3/16" x 2" x 5"
Legs | 3/16" x 2 1/2" x 5"
F.H.B. Screws | 1/4" #2
String | 36" long
Nails | 3/4" #20
Screweye | 1/4" #1216 1/2
COLOR CHART
COLOR | PART
Black | Body-Hat-Cuffs-Shoes
Orange | Collar-Legs-Arms
" | Buttons
Red | Nose and Mouth
Blue | Eyes
Shellac | Face and Hands
Gray | Back of all parts
BODY 1/2" SQUARES
LEGS 2 WANTED
ARMS 2 WANTED
1/2" SQUARES

Project submitted by Harold O. Akeson, East Orange, N. J.

jack. The pattern is drawn to the desired size and transferred to the selected wood, and cut out with a coping saw or a band saw. Each part must be sandpapered until smooth on both the surfaces and all edges. The face, collar, hat, shoes, cuffs, and buttons should be drawn on carefully and painted according to the colors listed on the chart. Many variations of colors are possible but the orange and white combination is very effective.

A nail, No. 20 by ¾ in., is put in the base of each arm and leg. String is tied securely to each nail, according to the directions shown on the diagram, and brought to a center piece of string which dangles about one foot below the body of the jumping jack.

By following accurately the arrangement of the string, represented by the dotted line on the diagram of the completed toy, the arms and legs of the jumping jack should fly upward when the end of the string is pulled. This is much more amusing and effective than one would suppose from the complacent appearance of the clown shown in the drawing.

Comic characters, such as Charlie McCarthy or personalities from the comic strips, may be substituted for the clown if one has the ability to enlarge and reproduce them accurately enough to be used as a pattern. Some of the comic strip characters are very simple and these lend themselves very effectively to the pattern for the toy.

Jumping jack

ASH TRAY AND PIPE RACK

R. E. MURRAY

Public Schools

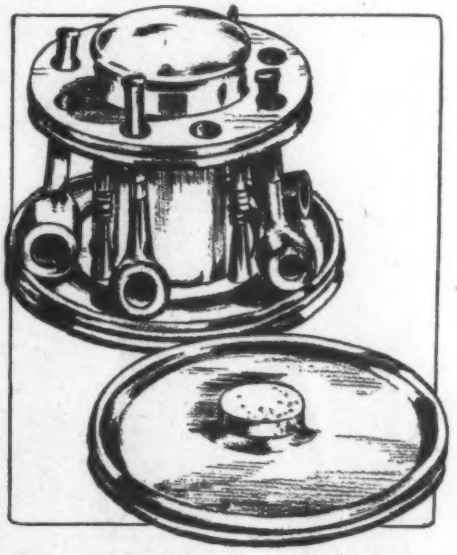
Fremont, Ohio

Either or both of the items described herewith afford splendid wood-turning practices which embody various fundamental operations.

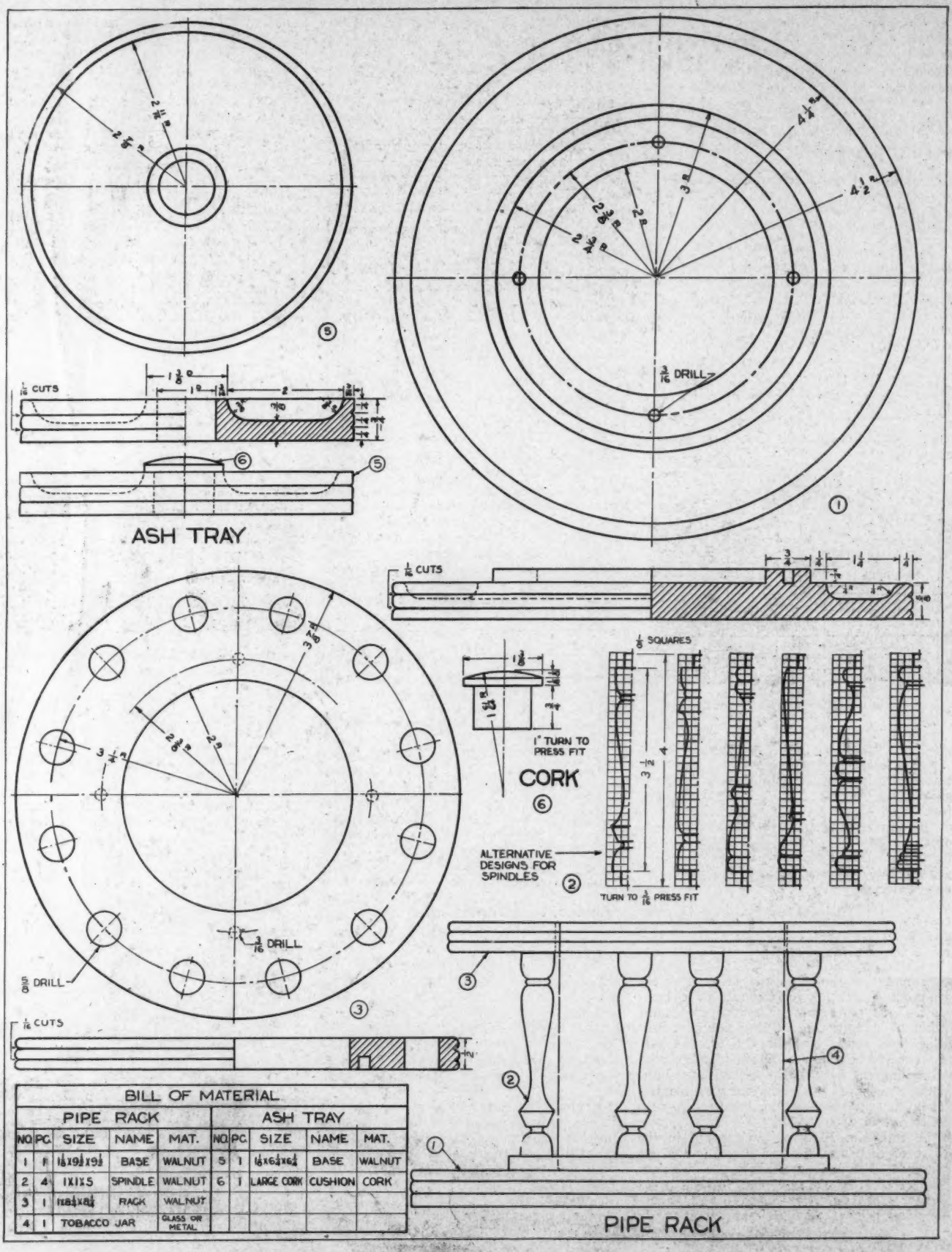
Any woods of a close-grained nature may be used, or woods of contrasting colors may be used to achieve a combination of pleasing appearance.

The instructor may follow the customary trade procedure to obtain a glossy or satin finish.

Since the holidays are near, this combination smoking set would please any father, brother, or uncle.



Ash tray and pipe rack



BILL OF MATERIAL

PIPE RACK					ASH TRAY				
NO.	PC.	SIZE	NAME	MAT.	NO.	PC.	SIZE	NAME	MAT.
1	1	1⅛X9½X9½	BASE	WALNUT	5	1	1/16X6¼X6¼	BASE	WALNUT
2	4	1X1X5	SPINDLE	WALNUT	6	1	LARGE CORK	CUSHION	CORK
3	1	11/16X8¼	RACK	WALNUT					
4	1	TOBACCO JAR		GLASS OR METAL					

Ash tray and pipe rack designed by R. E. Murray, Fremont, Ohio

It may also be developed on a commercial basis by creating a small production schedule which would lead to a merchandizing scheme, the purpose of which could be for raising school funds of different kinds.

GLIDER GROUND TRAINERS

LYNN A. EMERSON

Professor of Industrial Education

Cornell University

Ithaca, N. Y.

The glider ground trainer has an important place in the over-all program for developing air-mindedness on the part of American youth. It is a logical first step for the boy who looks toward the time when he can actually fly a glider or a power plane. A ground trainer is a device that looks like a glider, uses the same operating control devices, and in operation acts much like a glider. The important difference from the glider is that the ground trainer, as its name implies, does not leave the ground. It gets its action from being towed behind an automobile on a level field.

The tow car with its observation platform

The construction features of a ground trainer are very much like those of a real glider. The operating controls — stick and foot pedals — work just the same as those of a glider, and operate the control surfaces of ailerons, elevator, and rudder. The essential differences of construction between the ground trainer and the glider are in the manner of suspension of the two-wheel *landing gear*, in the relative areas of the wing and control surfaces, and in the weight. In the ground trainer, the landing gear is really a running gear. This is designed so that the trainer is suspended on a short shaft running lengthwise of the *ship*. The body of the trainer can rock on this shaft so that either wing tip can nearly touch the ground. The surface areas of ailerons, rudder, and elevator are very much larger in proportion to the rest of the ship than is the case in a real glider. This is because these surfaces must become operative at very much slower speeds than are used in actual glider flights. The weight of the ground trainer is usually greater than that of a glider of corresponding size.

Fastening the safety belt

The end of the trip

The common practice used in operating the ground trainer is to tow it behind an automobile on a level field. Because of their large areas, the control surfaces become operative at relatively low air speeds. This is essential from the standpoint of safety, because the ground trainer should operate effectively at speeds of about 15 miles an hour.

When in operation behind the tow car at a reasonable speed, the ailerons have sufficient control to raise or lower either wing, according to the position of the stick. The objective in training is to get the trainee so that he is able to keep the wings level by proper manipulation of the stick. As in a regular glider, the stick is pushed toward the high wing in order to bring the wings to a level position. The greater the air speed of the ground trainer, the more the ailerons respond to the stick. The air speed, of course, is dependent upon the speed of the tow car, and the amount and direction of the wind.

Keeping the ship in a level position fore and aft is also controlled by the stick through a forward or backward movement which operates the elevator. When the ground trainer reaches a given air speed, the elevator becomes operative, and the tail lifts off the ground. The operator attempts to keep the tail in such a position that the ship is on an even keel. Pushing the stick forward tends to raise the tail, which forces the nose of the ship downward. Pulling the stick backward tends to lower the tail and make the ship ride on its tail skid.

Steering is accomplished through the rudder which is operated by the two foot pedals. As with the ailerons and elevator, the ground trainer must reach the proper air speed for the rudder to operate effectively. Ground trainers are commonly constructed with tail skids which tend to cut down considerably the ability of the rudder to control the direction of the ship until sufficient air speed is attained to lift the tail off the ground.

It would appear to be very easy to manipulate the stick and pedals to keep the ship on an even keel, with wings level, and with the ship moving in the right direction. The beginner, however, finds considerable difficulty in co-ordinating his movements so that all the control surfaces are kept in the correct position. Unevenness of the ground tends to throw the trainer in one direction or another, and acts in a manner similar to bumpy air in the case of a real glider.

The ground trainer ready to be hitched to the tow car

The learning processes in a way are similar to those encountered in learning to drive an automobile. The operator must learn the different control mechanisms one at a time, and then learn to co-ordinate them for the various conditions encountered.

If operating conditions are carefully planned and controlled, there is relatively little hazard in ground trainer operation.

The ground trainer on the run

Risks are taken, however, when planning is not carefully done. The field should be large enough so that there will be no danger of running into obstructions of one sort or another. It is recommended that a reasonably level field at least 300 by 1200 ft. be used for this purpose. When operated by a learner, the ground trainer may easily swing considerably out of its normal line of travel, and a clear space is essential. Experimental work at Cornell University in trying out ground trainers built during the summer of 1942 indicated that an ordinary road or race track does not have sufficient space for safe operation. Fences constitute a real hazard.

The ground trainer is equipped with a safety belt for the operator, and care must be taken to insure that it is used. Sometimes the operation is rather bumpy when the ground is uneven, or when there is considerable wind.

The tow car should be equipped with a platform of some sort from which the instructor can direct the movements of the trainee. In normal operation, the trainer is released from the tow rope by the trainee upon the proper signal from the instructor. As the trainee may get rattled and fail to pull the release, it is desirable that the tow car also be provided with an emergency release which can be operated by the instructor.

It is essential that an adequate system of signals be worked out and learned by the trainee so that the instructor in the tow car may signal to the trainee, indicating to him the things he should do to bring the ground trainer to a level operating condition.

It appears to be good practice to have the trainee learn one of the controls at a time. He may learn to steer the trainer by the use of the foot pedals, keeping ailerons and elevator locked. After he has mastered this he may learn the operation of the stick as it controls the elevator and the ailerons. Later all can be co-ordinated. In the early stages, when the trainee is learning to operate one of the controls, it is desirable that the trainer be kept connected to the tow car by the tow rope. After the trainee has learned the different controls and has learned to operate the tow release, he is given practice runs which require use of all the controls.

In normal operation, the tow car is lined up ahead of the ground trainer, heading into the wind as nearly as possible. The tow rope, usually about 60 ft. long, is fastened to the tow release of the ground trainer, and a check is made to see that it operates properly when the trainee pulls the release lever. Care is taken to make sure the trainee has fastened his safety belt securely. Slack is then taken up in the tow rope in the same way as is done when one automobile tows another. It is essential that the tow rope be kept tight to avoid undue strain on either car or trainer. When the slack is taken up, the signal is given for the car to go forward and a speed of ten to fifteen miles an hour is quickly attained.

As the car and ground trainer move along, the instructor signals to the trainee that one or the other wing is low, or that the ship is not on an even keel. After progressing perhaps two thirds of the length of the field, the instructor signals the trainee to release the tow rope. Upon release of the tow rope, the tow car turns out of the path of the oncoming trainer, and the trainee is on his own with respect to controlling the ship. Momentum usually carries it on a considerable distance and the trainee stops the ship by pushing the stick forward, thus raising the tail and putting the ship over onto its nose skid.

At the relatively low ground speeds used for the ground trainer operation, the trainee experiences many of the same sensations as in a real glider landing or taking off. Through ground trainer experience, he gains confidence in his ability to operate the controls and thus cuts down materially the time required in learning the operation of the controls in either a real glider or a power plane.

The hazards of ground trainer operation are so low that it would seem that this type of training should find an important place in the preflight aeronautics program of the secondary schools of America. Ground trainers can be built in the average industrial-arts shop, with little if any additional equipment. A subsequent article will describe the construction of the ground trainers built at Cornell in the summer of 1942.

REPULSION VANE-TYPE METER

A. G. BELESON

Public School 139

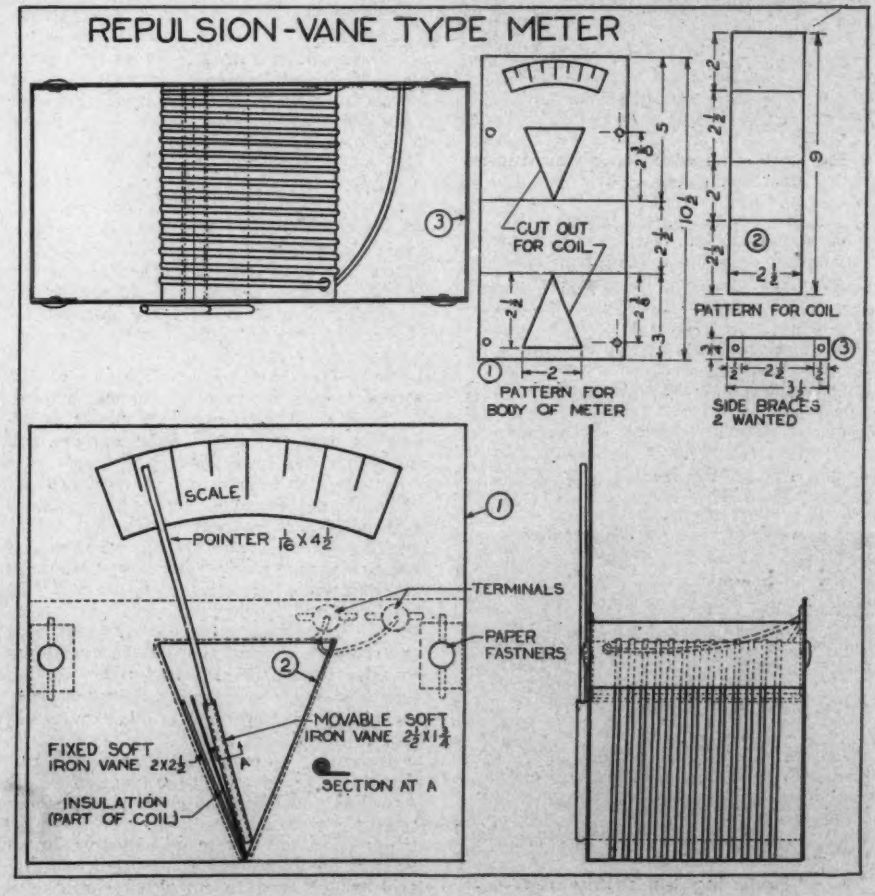
Manhattan, New York City

This type of meter may be used on a.c. or d.c. electricity. It works on the principle that like magnetic poles repel each other. It has two soft iron vanes, one of which is fixed, and the other movable. The pointer is attached to the movable vane. Both vanes are located inside of the triangular coil which carries the current that is to be measured. The vanes become magnetized and repel each other when the current flows through the coil. The stronger the current, the greater the repulsion. When alternating current is applied, the polarity of the two iron vanes is constantly changing, but the repulsion is always present.

Materials Required

6 paper fasteners
50 ft. of No. 22 magnet wire
1 pc. 9 by 11½-in. heavy cardboard (preferably show cardboard)
1 pc. wire — 1/16-in. dia. by 4½ in.

This particular meter will operate on 6 volts a.c. or d.c. It can also be operated on 110 volts a.c. or d.c. if a resistance coil is placed in series in the line.



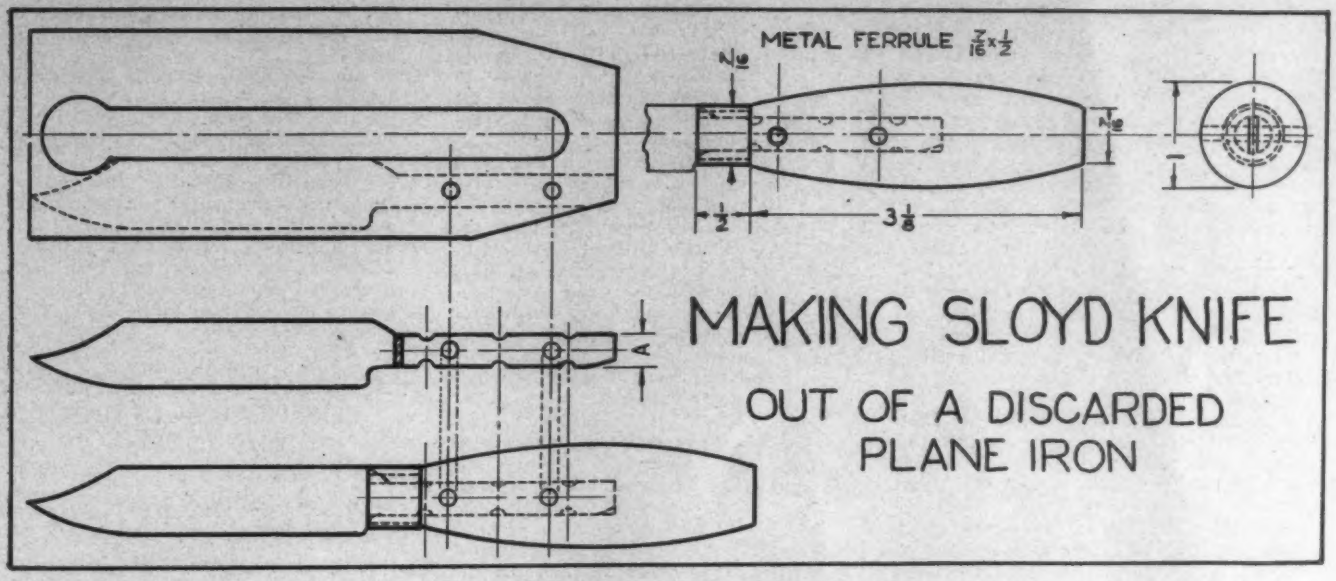
MAKING A SLOYD KNIFE OUT OF A DISCARDED PLANE IRON

LOUIS F. BAROCCI

High School

Cudahy, Wis.

1. Choose a suitable discarded plane iron.
2. Trace pattern on plane iron and shape on grinder. Do not burn. Harden and temper blade if necessary before placing permanently in handle. Notches and holes are for molten metal to flow into and make the knife secure.



Project submitted by Louis F. Barocci, Cudahy, Wis.

3. Turn hardwood handle on lathe and shape by hand at bench.

4. Fit ferrule on handle and put back on lathe to polish ferrule with a file (use file with handle only).

5. Locate and bore two 1/8- or 3/16-in. holes in handle.

6. Drill hole in handle the size of the knife shank at A.

7. Insert knife in handle. Locate holes and drill to match holes in the handle. Molten solder flows into these holes and fastens the blade better than can be done with rivets.

8. Wrap friction tape around the handle so that these holes in the handle are covered. This will prevent the molten metal from flowing out.

9. Place the handle in the vise and insert blade in correct position.

10. Pour molten solder or babbit into handle and allow it to solidify. The metal flows into the holes and notches, making a secure fit.

11. Remove tape and apply finish to the handle.

12. Polish the blade with emery cloth and oil.

AIRPLANE SHEET-METAL SHOP PRACTICE

M. D. CAFFIN

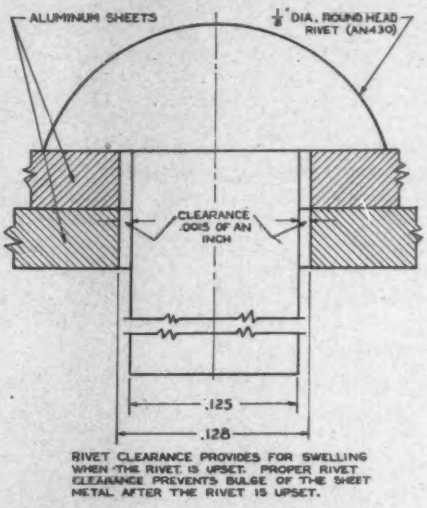
Public Schools

Newark, N. J.

(Continued from page 389 of the November, 1943, issue)

Diameter of Drilled Holes for Various Size Rivets

In order to obtain a rivet joint of maximum strength it is necessary to give some consideration to the diameter of the hole that is to be drilled to receive the rivet. It is obvious on consideration that the hole cannot be exactly the same diameter as the rivet. This is due to the fact that the rivet diameter expands when it is upset or hammered, and unless some allowance is made for this in the diameter of the hole, the rivet would press against the sides of the hole and cause the sheet metal to buckle.


ALUMINUM SHEETS
1/8" DIA., ROUND HEAD RIVET (AN430)
CLEARANCE .005 OF AN INCH
.125
.128
RIVET CLEARANCE PROVIDES FOR SWELLING WHEN THE RIVET IS UPSET. PROPER RIVET CLEARANCE PREVENTS BULGE OF THE SHEET METAL AFTER THE RIVET IS UPSET.

On the other hand, the drilled hole may not be too much larger than the rivet, or a weak rivet joint will result.

It has been found through practice that the larger the diameter of the rivet, the more clearance, that is, rivet hole clearance, should be provided.

For the ordinary small rivets commonly used in airplane fabrication, the drill diameter should be at least .003 in. larger than the rivet diameter. In the case of a 1/8-in. rivet which is .125 in. in diameter, the proper drill size is a No. 30 drill which has a diameter of .1285 in. As the rivet increases in diameter, the clearance also increases. A 1/4-in. rivet requires an F drill which is .257 in. in diameter.

How to select the proper diameter drill: After deciding upon the diameter of rivet that is to be used, refer to a drill chart that lists in order of increasing size all of the drills available in number, fraction, and letter sizes. If, for example, you are using a 5/32-in. rivet, the decimal for 5/32 is .1562. Locate this decimal on the drill chart, and then by glancing down the chart to the next size of drill, locate the next drill that is at least .003 larger than the rivet. To illustrate this a portion of the drill chart is reproduced here:

Drill Sizes		
Fraction	Number or Letter	Decimal Equivalent
9/64		.1406
	27	.144
	26	.147
	25	.1495
	24	.152
	23	.154
5/32		.1562
	22	.157
	21	.159
	20	.161
	19	.166

The correct drill to use for the 5/32-in. rivet is, therefore, the No. 21 drill which is .159 in. in diameter. While this drill is .0002 in. smaller than the suggested .003-in. minimum clearance, it is used in preference to the next larger drill which is .161 in., and would provide too much clearance, and make it too difficult to upset the rivet without bending it.

Drills for popular size rivets: The following drill sizes and decimal equivalents for 5 standard diameter rivets are most widely used in airplane fabrication:

Rivet Sizes		Drill Sizes	
Fraction	Decimal Equivalent	Number or Letter	Decimal Equivalent
3/32	.0937	40	.098
1/8	.125	30	.1285
5/32	.1562	21	.159
3/16	.1875	11	.191
1/4	.25	F	.257

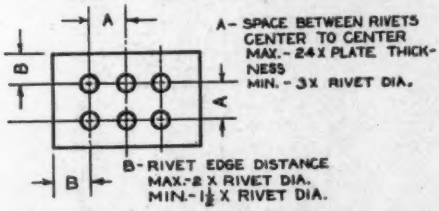
Considerations in selecting the rivet diameter: The function of the rivet is to hold two or more pieces of metal together. The strength of a rivet joint, therefore, is directly affected by: (*a*) the alloy metal of the rivet; (*b*) the diameter of the rivet; (*c*) the number of rivets used to hold the metal together.

*Type of rivet used (alloy):** In general the same alloy rivet should be used as the metal that is being joined. Heat-treated rivets, type D and DD, are stronger than nonheat-treated rivets, types A and AD. However, no more strength is required of the rivet than is available in the metal sheets being held together by the rivet. Therefore, the general rule is that if the sheet metal is a heat-treated alloy, the rivet should be similarly a heat-treated alloy rivet.

Rivet diameter: A large rivet in thin sheet metal provides shear strength in excess of what the sheet metal itself provides. Further, the hammering required to properly upset the large diameter rivet is apt to cause a stretching or bulging of the sheet metal around the rivet head. On the other hand, a rivet of too small a diameter will not provide the shear strength that is required to hold the two pieces of metal together. A good general rule to follow is: (*a*) rivet diameter should not be less than the thickness of the thickest metal through which it is driven; (*b*) the rivet diameter should not exceed 2½ to 3 times the thickness of the sheet metal through which it is driven.

Rivet spacing: The number of rivets that are driven in a given area directly affect the strength of that particular joint. For example, if the rivets are spaced too far apart the sheet metal is likely to buckle between adjacent rivets. On the other hand, they should be spaced far enough apart to permit easy upsetting. In general: (*a*) minimum spacing between rivets is 3 times the diameter of the rivet; (*b*) maximum spacing between rivets should not be greater than 24 times the thickness of the plate through which they are driven.

There are variations to the foregoing rules dependent upon individual plane design, but in general the rule will be found to hold true.


A
A- SPACE BETWEEN RIVETS CENTER TO CENTER MAX.- 24 X PLATE THICKNESS MIN. - 3X RIVET DIA.
B
B- RIVET EDGE DISTANCE MAX.-2 X RIVET DIA. MIN.-1½ X RIVET DIA.

Rivet edge distance: For maximum bearing strength rivets should be placed at a distance from the edge of the sheet metal not more than 2 times the diameter of the rivet. That is, the distance from the edge of the sheet metal to the center of the rivet hole.

Rivets that are placed too close to the edge of the sheet metal are likely to cause buckling of the edge. Therefore, a good general rule for minimum rivet-edge distance is 1½ times rivet diameter.

Questions

Directions: If a statement is true, encircle the letter T; if false, encircle the F.

Fill in correct answers in the completion questions.

T F 1. The diameter of a rivet usually should not be more than 2½ to 3 times the thickness of the sheet metal to which it is applied.

T F 2. Too large a rivet in thin metal may cause bulging around the rivet when upset.

T F 3. A space at least 1½ times the diameter of the rivet should be allowed between the edge of a sheet and the center of the hole.

T F 4. Recommended edge distance for rivets is 2 times the rivet diameter.

5. The primary consideration in a rivet joint is .....

6. Rivet ..... and ..... are two important factors in all rivet joints.

7. Recommended minimum spacing of rivets is ..... the rivet diameter.

8. Recommended maximum spacing between rivets is ..... the thickness of the sheet metal.

T F 9. A loose rivet may be upset to fill the hole if hammered sufficiently.

T F 10. Proper rivet clearance is .010 in. for a ⅛-in. rivet.

T F 11. Rivet clearance is the amount the rivet length clears the sheet metal.

ANSWERS TO QUESTIONS

1. T; 2. T; 3. T; 4. T; 5. strength; 6. size, spacing; 7. 3 times; 8. 24 times; 9. F; 10. F; 11. F.

TECHNIQUES IN USING THE JIG SAW

JOHN McINNES

Bremerton, Wash.

Names of Parts of Jig Saw

1. Base
2. Arm
3. Guide assembly
4. Guidepost
5. Tension spring
6. Upper chuck
7. Table
8. Table insert
9. Lower chuck
10. Motor
11. Pulleys
12. Belt adjustment slots
13. Crankshaft
14. Table tilting mechanism
15. Pressure foot

Use of Jig Saw

1. Putting in jig-saw blades
   - *a*) Set blade in vertical position in lower chuck.
   - *b*) Revolve pulley by hand until highest position of blade is reached.
   - *c*) Push upper chuck down until you can clamp it on upper end of blade. Take care not to get blade too tight.
   - *d*) Revolve machine around once by hand to make sure that blade is long enough not to pull tension spring down too far.
   - *e*) Set pressure foot on guide so that it touches top of stock lightly.
2. For ordinary sawing, feed work in just as saw will take it.
3. To cut square corners, rough out pattern and then make finish cuts.
4. For cutting out inside patterns, drill a hole in waste stock, stick saw blade in hole, and fasten blade in as described in Part I.
5. To use saber blades, fasten in lower chuck only using the V jaws.
6. Use the widest blade possible at all times; broken band saw blades make good saber blades for the jig saw.
7. For ripping long stock, turn the chucks of the jig saw at right angles and clamp blocks in place on the table for a fence.
8. To cut patterns for an inlay, tilt table slightly to one side and cut at an angle so that saw cut will not show. Take care to keep on the same side of the blade all the time in angle sawing.

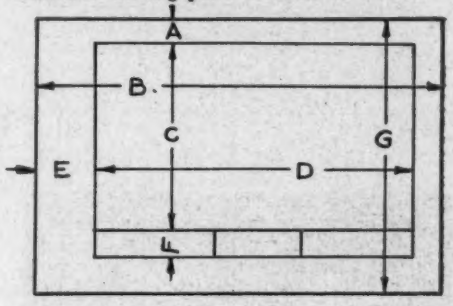
ORTHOGRAPHIC PROJECTION — IDENTIFICATION OF LINES AND TOOLS

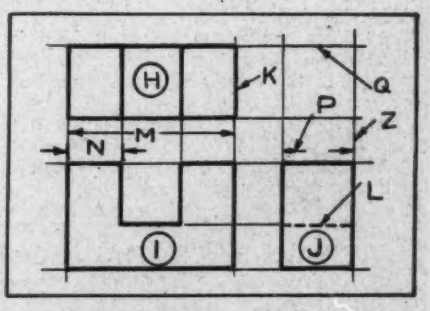
HARRY F. MERGLER

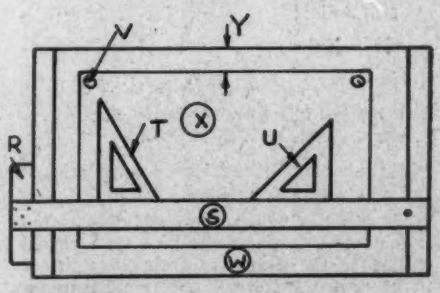
West Technical High School

Cleveland, Ohio

Directions: Below are diagrams with letters indicating values, tools, and lines. In the parentheses opposite the names and values listed, indicate the letter best suited. Teachers may substitute dimensions used for their own standard drawing plate in items 19 to 25.







1. blocking-in line ( )
2. blade ( )
3. board ( )

*See page 388 of the November, 1943, issue.

4. dimension line ( )
5. detail dimension ( )
6. extension line ( )
7. front view ( )
8. head ( )
9. invisible edge line ( )
10. over-all dimension ( )
11. paper ( )
12. side view ( )
13. top view ( )
14. thumbtack ( )
15. 45-deg. triangle ( )
16. 30 to 60-deg. triangle ( )
17. visible edge line ( )
18. 2 in. ( )
19. 9 in. ( )
20. ½ in. ( )
21. 7⅜ in. ( )
22. ⅝ in. ( )
23. 1 in. ( )
24. 12 in. ( )
25. 10½ in. ( )

WHITTLING-JACKKNIFE TECHNIQUE

W. BEN. HUNT

Hales Corners, Wis.

(*Continued from page 387 of the November, 1943, issue*)

Rearing Horse

After repeated requests to add a horse to this series of whittling projects, the author herewith presents one which may seem unduly difficult. This is not the case, however, and after the silhouette has been prepared, and the animal has been blocked out, the job will look a lot easier.

Probably the most difficult parts to carve are the back legs and the tail. The tail is attached to the base, as shown, in order to give greater strength. This is not strictly necessary, especially if woods like walnut or mahogany are used, since the horse is so carved that the grain runs up and down.

The horse shown in Figures 135 and 138 was carved from a block of mahogany. This wood cuts easily and it can be finished beautifully with either mahogany or walnut stain.

If Honduras mahogany is used, the body may be given a light coat of walnut stain, with the mane and tail left natural, thus giving the horse the appearance of a beautiful Palomino pony.

The photograph for the illustration shown in Figure 135 was taken before staining. Dupont walnut oil stain was then applied. After this was dry, the statuette was waxed and polished, and it now has the appearance of old bronze.

Fig. 135. The rearing horse

MOLDING PLASTICS IN HIGH SCHOOL

DALE PETERSON

Formerly Teacher of Woodwork and Hobbies

Irving High School

Salt Lake City, Utah

Now in the U. S. Army

(*Continued from page 302 of the September, 1943, issue*)

Natural and Synthetic Resins

Plastic resins from which molding powders are made may be divided into two classes—natural and synthetic. The natural resins or gums are those that are produced by nature as the resins and gums from trees and plants or those resins that are found as mineral deposits.

Shellac and rubber are examples of natural resins from which plastic products are made. Gilsonite and other tars or fossilized resins

Fig. 136. The silhouette

Fig. 137. Rear view of rearing horse

are examples of those that are found in the earth.

The synthetic resins are those that are made by man through chemical combination. These are typified by the phenolics, acrylics, styrenes, and vinyls — resins from which most of our present plastic articles are made.

Both natural and synthetic resins are used in the manufacture of plastic articles. The synthetics, however, are quite largely replacing the natural resins because of their more unlimited source of supply and because of their better physical and chemical properties. Phonograph recordings, formerly made from shellac and the last stronghold of the shellac plastics, are now being made with the synthetic resins whose flexibility and better reproduction of sound are superior to shellac.

Thermoplastic and Thermosetting Plastics

The most useful classification of plastics is according to their properties and not according to their sources. Such a classification gives two distinct divisions — *thermosetting* and *thermoplastic* resins.

The thermosetting plastics, when under the

(Continued on page 435)

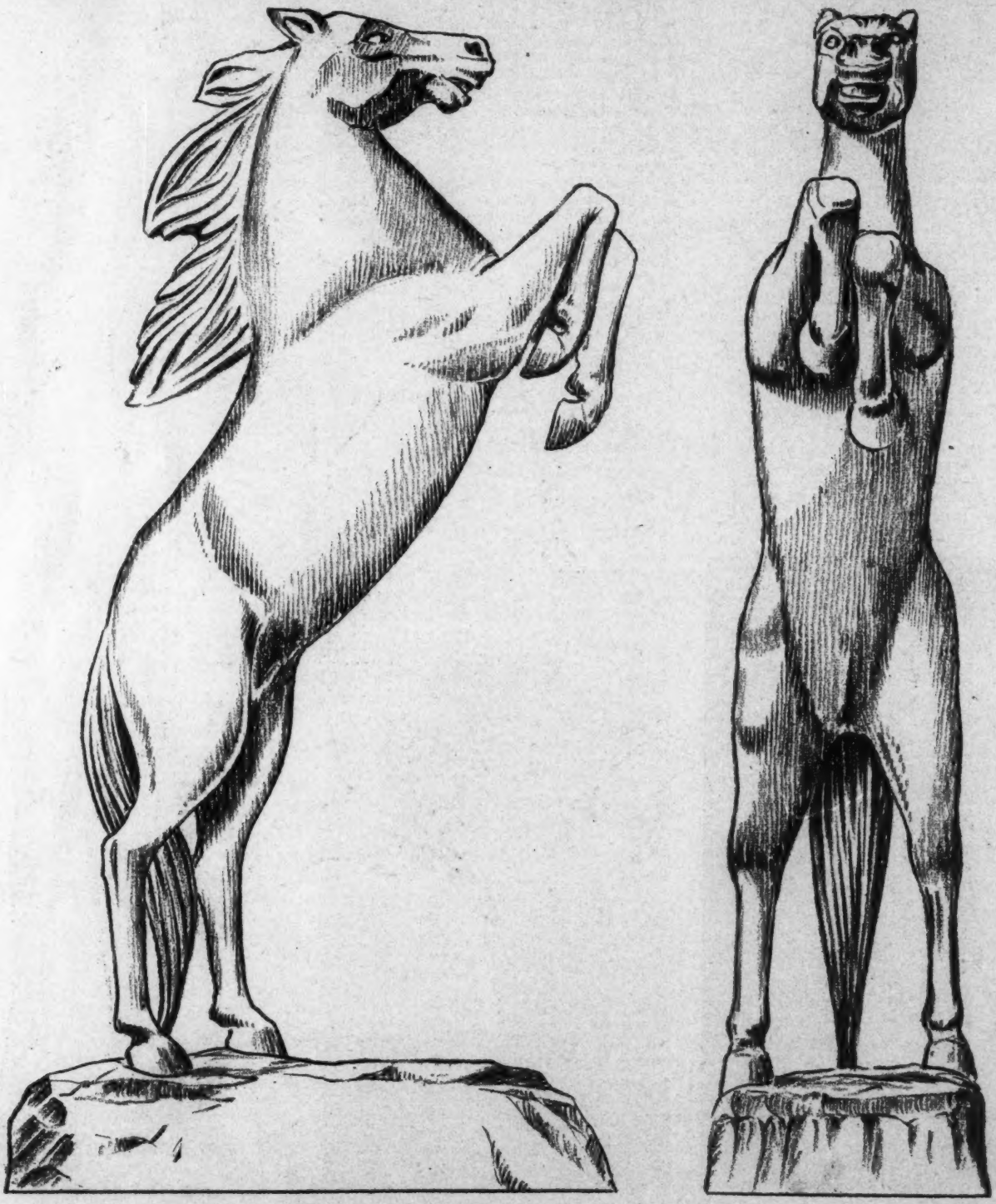


Fig. 138. Side and front view of rearing horse

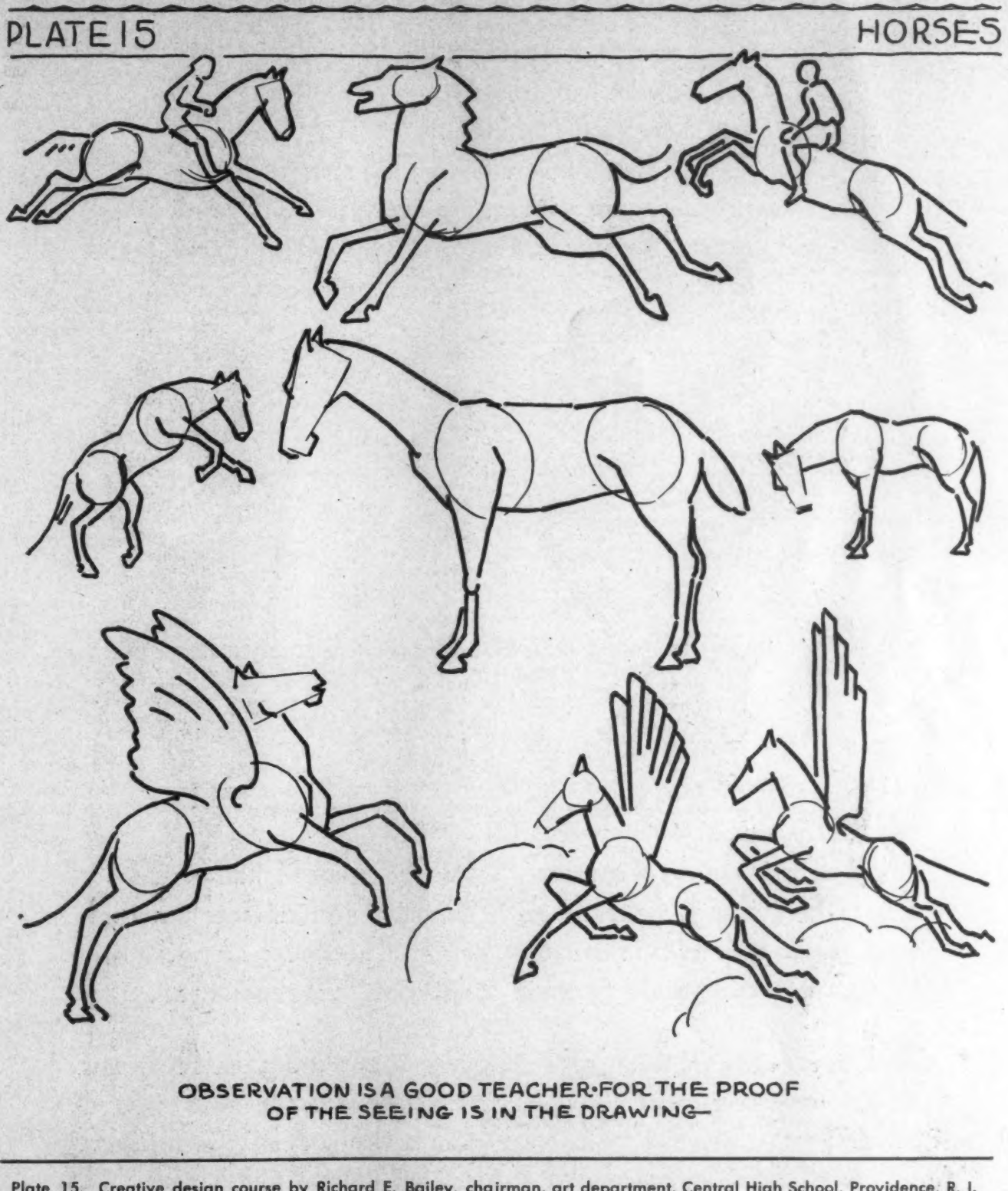
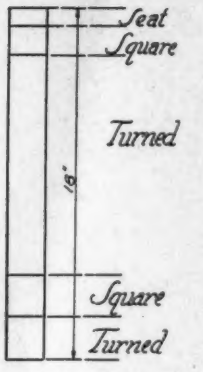


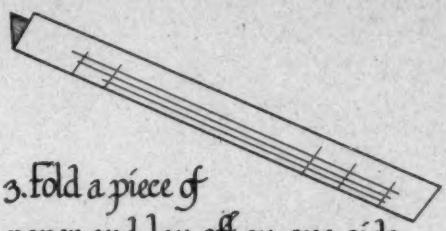
Plate 15. Creative design course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

HOW IS A DESIGN FOR TURNING USED?

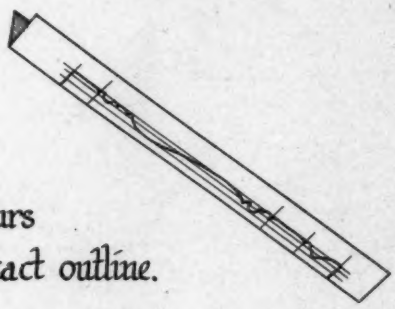


Chair Leg

1. Lay off all fixed dimensions, and areas not to be turned, such as the squares for joining rails and stretchers.
2. Outline major diameters, and size of square stock to be cut.



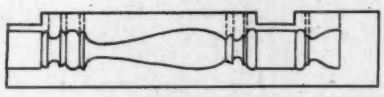
3. Fold a piece of paper and lay off on one side the previously determined dimensions in full size.

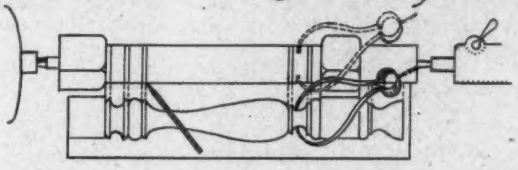


4. Draw contours in detail and exact outline.

5. Cut away paper outside lines.

6. Open, connect points, and examine pattern. Make corrections or try another pattern.





7. Paste this pattern to a piece of thin wallboard, pressboard, or thin veneer. Extend all arrises to edge of mounting board. This will permit the accurate and rapid transfer of all points to the revolving stock through the touch of a pencil.

8. By setting calipers to actual diameters on the pattern depth cuts may readily be made. The turning is completed by connecting these points by eye.

The lathe is an excellent example of a tool whose use distinctively affects the product. It differs from straight line cutting tools (such as the plane) in that it imposes few restrictions on form. Designing for the lathe is made more difficult by this very freedom. Order and balance must be guarded vigorously lest the result be only chaos. As a rule simplicity helps to produce work most likely to give lasting satisfaction.

Plate 28. Design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

(Continued from page 432)

influence of heat, remain in a softened state for only a short period of time. It is during this period that all molding operations must be done. Prolonged heating only makes the material harder rather than softer until it reaches the state when heat will no longer soften it.

The thermoplastic types can be heated for long periods and reheated many times without becoming hardened. They soften each time they are heated to the molding or softening temperature.

For school use, where the students are apt to make mistakes in molding, it is obvious that the thermoplastic types are best. They can be remolded at any time in case the first molding was not successful. Scrap materials can be reground to make usable molding powder and used again and again. The thermoplastics also have a lower softening point and consequently require less heat to soften them. This is quite an advantage when hot molding dies and materials must be handled by students and the likelihood of bad burns is less in using the thermoplastics. These same plastics do not stain the steel molding dies as do the thermosetting plastics. They do not release poisonous formaldehyde fumes as do most of the thermosetting plastics when heated. These fumes harden lung tissues and often are objectionably strong.

The thermoplastics, while possessing many advantages, also have some disadvantages. The greatest of these is their low softening temperature. Since they soften at a much lower temperature than the thermosetting plastics, they cannot be used to manufacture articles which are to be used around heat or in warm places. As stated before, however, this is an advantage at times since it makes them easier to form and shape by the novice while they are under the influence of heat.

Similarly, the thermosetting plastics, while not perfectly adaptable to school use, do possess some fine qualities. These qualities make their commercial usage very large. First, they are heat resistant. That is, they do not soften when around heat and can be used as handles for cooking utensils, parts for gasoline and electric motors, parts for lamps, stoves, and many other similar uses. They can also be effectively molded in stainless steel molding dies, or dies whose surfaces have been plated with nickel or chromium.

Chemically, the thermoplastics are more readily dissolved by solvents than are the thermosetting plastics. This is an advantage in the manufacture of paints and varnishes (thermoplastics dissolved in the proper solvents and oils make excellent finishing materials). In the resistance to acids and alkalis the thermoplastics, with the exception of the acetates, are about as good if not better than the thermosetting plastics.

The common thermoplastics are as follows: shellac, cellulose acetate, ethyl cellulose, cellulose butyrate, nitrate cellulose, vinyls (vinyl chloride and vinyl acetate), styrenes, and the acrylics. They are marketed under a variety of trade names which are listed in a later article.

The most common thermosetting plastics are the phenolics, ureas, and caseins.

Fillers

Plastic resins, whether natural or synthetic, are not always used in their pure form, but are usually mixed with some kind of a filling material called *fillers*. Fillers enable the manufacturer to make plastic articles much more cheaply than would be possible if the pure resins were used without the filling material. Such fillers make much more plastic material available, and in most cases, the quality of the article is as good if not better than if no fillers were used.

The common fillers are wood pulp, cotton linters, asbestos fibers, zinc oxide, lampblack, and other mineral colors. These fillers are mixed with the plastic resins which saturate and surround the particles of filler and thus bind them together to make a material that greatly resembles the pure resin in texture.

Fibrous fillers, as wood pulp and cotton linters, add tensile strength to the manufactured plastic articles. Fillers are also used to make opaque or translucent colored plastic articles. Without these fillers, the clear resins could not be thus adapted. Fillers also serve to overcome the excessive stickiness that some of the pure plastic resins possess. Without the fillers and an additional lubricant such resins would adhere to the molding dies.

Lubricants and Plasticizers

In order to make the plastic properly flexible and pliable, certain ingredients called plasticizers are added to the molding powder in its manufacture. Some plastic resins do not need such ingredients while others do, particularly for molding operations, so that the molding powder will properly soften and flow into the parts of the mold when it is subjected to proper amounts of heat and pressure.

Many plasticizers also act as lubricants and prevent the plastics from adhering to the molding dies, mixing rolls, and platens. Others require the addition of another lubricating material.

MODERN BOOK ENDS

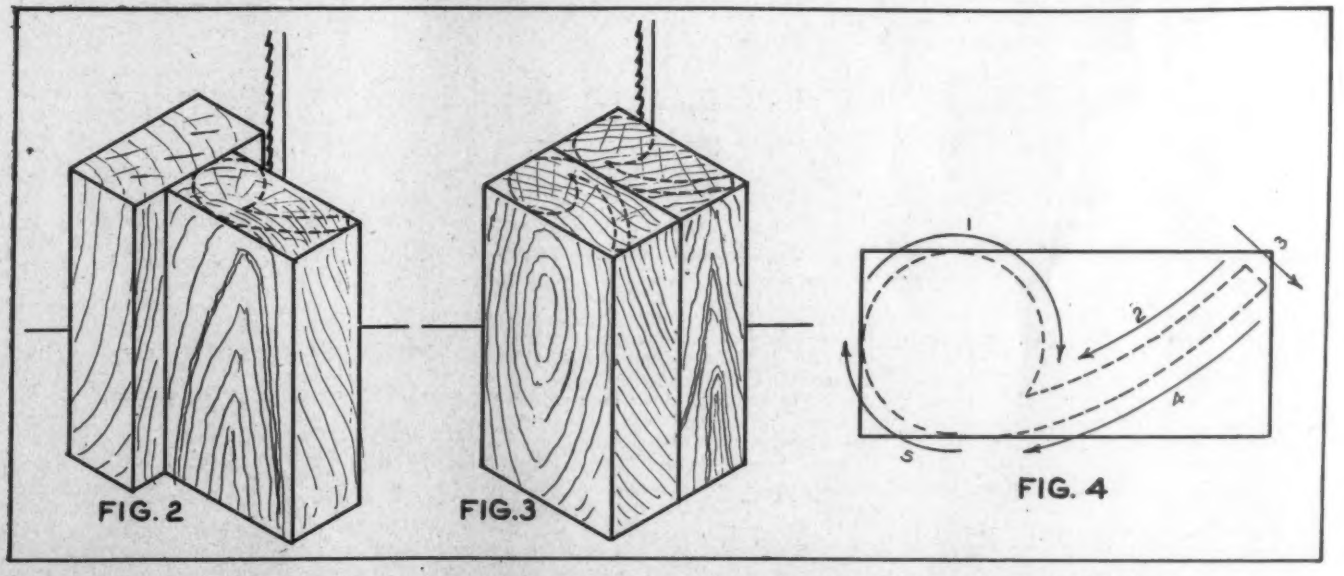
R. B. NEWHAUSER
Shorewood High School
Milwaukee, Wis.

A few well-chosen book ends attractively displayed will enhance the beauty of any home if they are in harmony with the general decorative scheme. Modern design lends itself to the fulfillment of this ideal.

These book ends are quite within the capability of the average high school student, combining woodwork with a small amount of metalwork. The wood used can be either mahogany, walnut, or maple having a nice figure of grain.

Cut two 2 by 4 by 6-in. blocks from the wood selected, making sure that they are accurate as to size. This is very important in the later operations. Next, lay out ¼-in. squares on a piece of heavy paper and on this draw a pattern of the shape shown in Figure 1. Then cut out the pattern with a pair of shears. It is important to do this part quite accurately as this serves as the pattern for both the right- and left-hand book end.

Apply the paper pattern to the end of each of the blocks, making one a right-hand book



Figs. 2 and 3. Making the sawing out process on the book ends safer. Fig. 4. Sequence of cuts

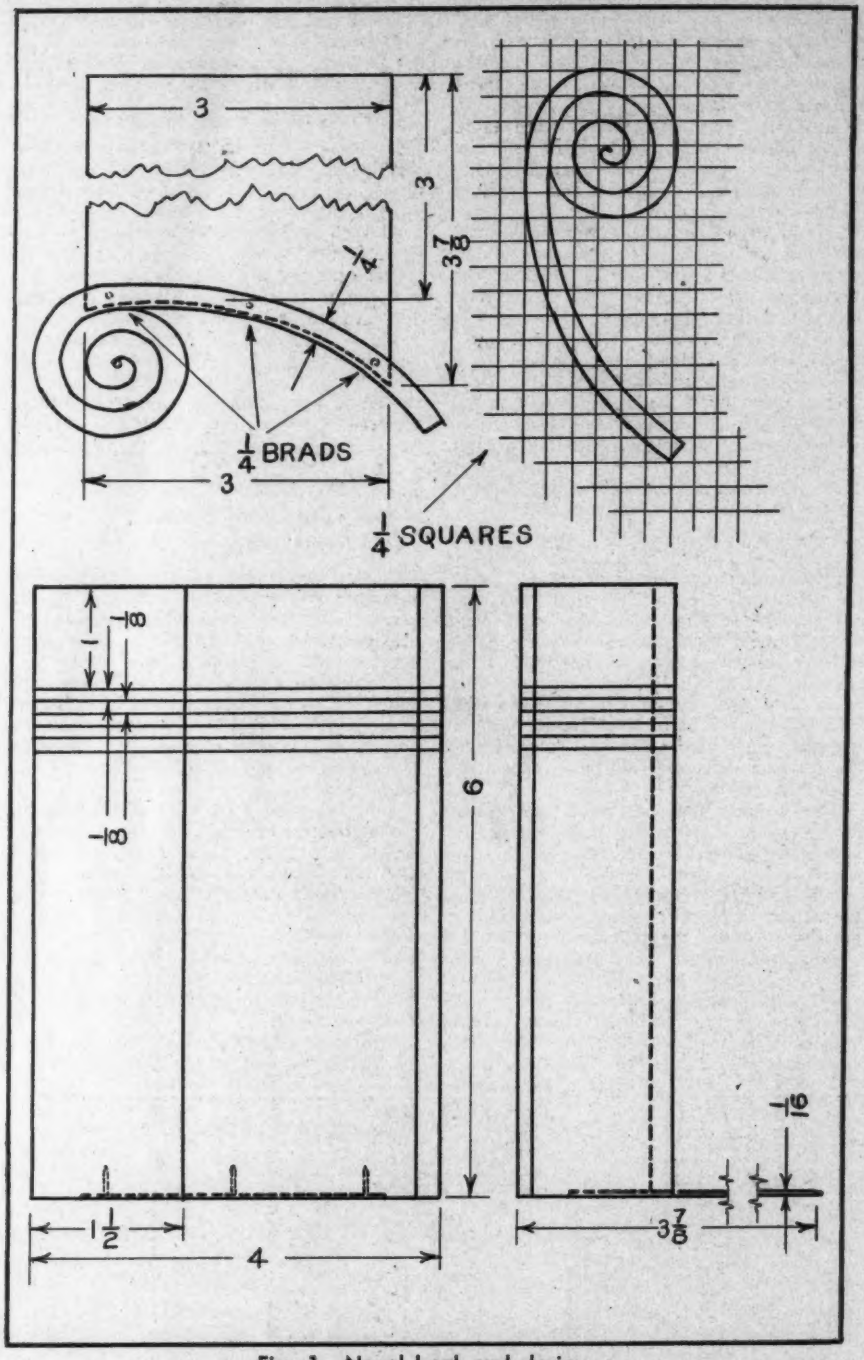


Fig. 1. Novel book-end design

end and the other left hand, carefully drawing the outline onto the wood with a sharp pencil. After this has been done the blocks are ready to be sawed out. This is best done on a band saw, preferably with a recently sharpened blade, because sawing end grain requires a very sharp saw. A ¼-in. saw should be used. Extreme care must be used in sawing the blocks in the end position. A slow, even feed must be used to prevent binding and a possible accident if the blocks are sawed alone. The author recommends that a backing be glued to the regular block, as shown in Figure 2. This provides a better protection for the student. If care is used in the sawing operation, following the procedure indicated in Figure 4, much work later can be avoided in filing and smoothing up. The method in Figure 3 shows both blocks glued together for sawing. They are separated by the last saw cut.

After being filed and sanded smooth the scroll should be completed on the top by means of a veining tool, as shown in Figure 1. Next the bottoms are undercut with a chisel or with a circular saw to provide a footing for the flat metal piece which the books rest upon. This metal piece can be of brass,

Fig. 5. The book end without the metal base

aluminum, or galvanized iron. If the latter is used it should be lacquered a green color, although any color may be used which will go well with the wood used.

The metal decorations shown in Figure 5 consist of three ⅛-in. bands of 1/32-in. chromium-plated zinc, 12 in. in length. Brass or copper may be substituted or even foil tape if the metal strips are unavailable. The bands are formed to shape by bending around the book end, taking care to have the joint meet in the back, where they are to be fastened by means of a small brad. To prevent the bands from loosening up, heat them as hot as can be handled while being applied. After the bands have been temporarily fitted they should be removed so that the finish may be applied.

The author has found that two coats of thinned lacquer rubbed with No. 3/0 steel wool between coats gives the most satisfactory finish. After the finishing has been completed, the ornamental bands and the metal bases are put on permanently. A piece of felt glued on the metal bases will prevent any marring of the surfaces upon which the book ends may be placed.

Due to the simplicity of the design care should be taken to make them as smooth and accurate as possible for any slight inaccuracies in workmanship will undoubtedly show up in the finished product. Material such as short blocks may be utilized as well as knotty parts of boards. These frequently provide most beautiful grain effects if care is taken to match the ends to each other.

THE JEWELER'S VISE

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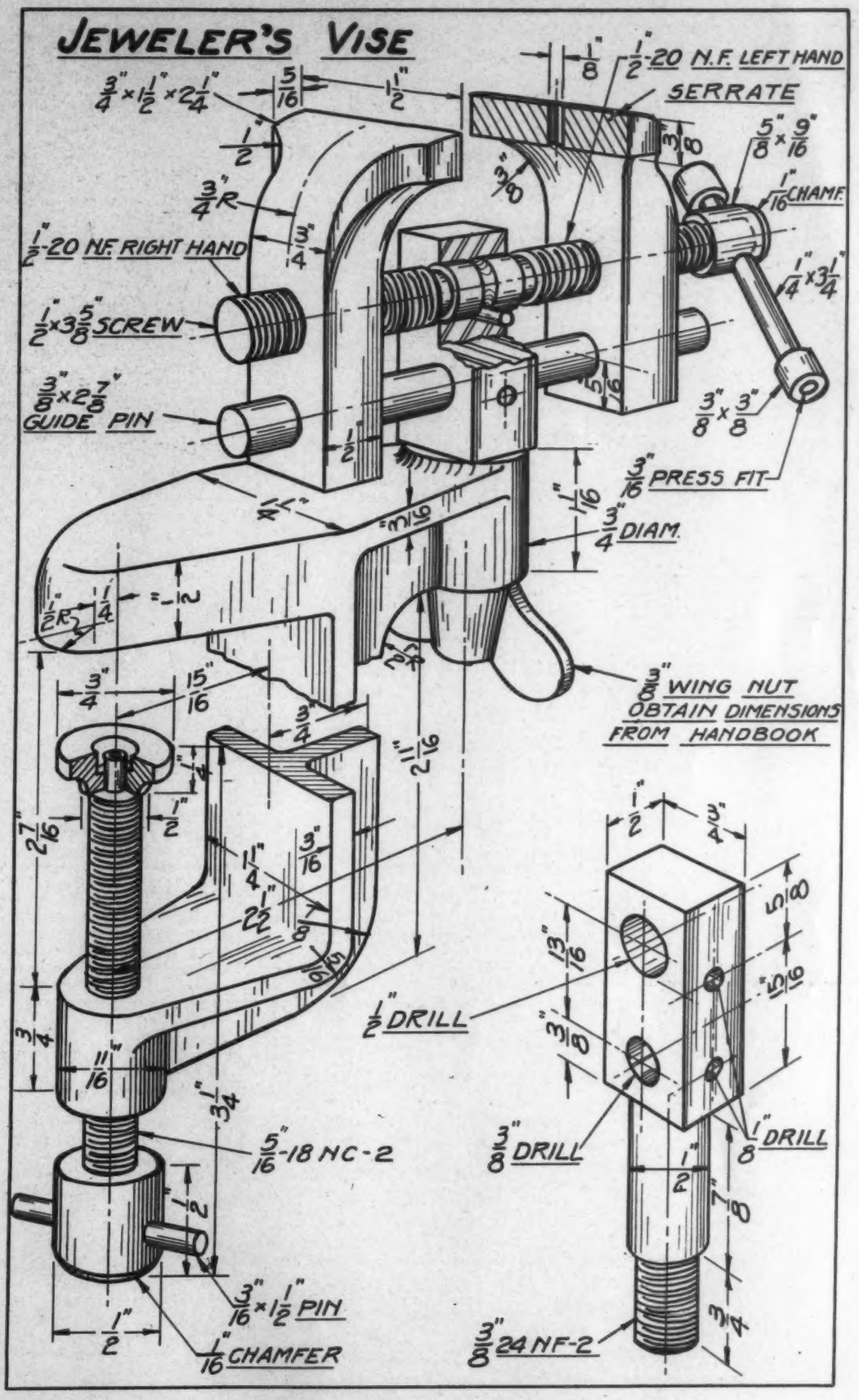
Technical High School
Erie, Pa.

As a drafting problem the jeweler's vise has many advantages. It is a complete unit in itself, easily understood by the student because a vise is something with which he



Submitted by William A. DeVette, Technical High School, Erie, Pa.

is acquainted. It has a few very simple parts, and a number of parts of greater difficulty. It involves coarse and fine threads and also right- and left-hand threads.

The whole problem is of such dimensions that all of the parts and the assembly as well may be drawn full scale on a sheet no larger than 15 by 22 in.

The student should be instructed to make the details from the perspective and the assembly from his own details without reference to the problem sheet.

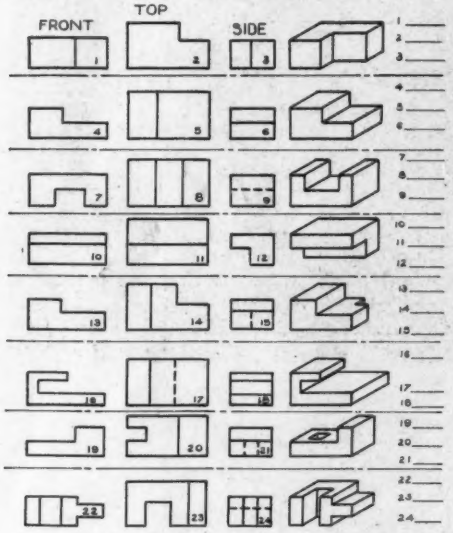
ORTHOGRAPHIC PROJECTION — RECOGNITION OF VIEWS

HARRY F. MERGLER

West Technical High School

Cleveland, Ohio

Directions: Some of the front, top, and side views are true and some are false drawings of the perspectives. Mark the true with an (X) and the false with a zero (O).



1. ( )	9. ( )	17. ( )
2. ( )	10. ( )	18. ( )
3. ( )	11. ( )	19. ( )
4. ( )	12. ( )	20. ( )
5. ( )	13. ( )	21. ( )
6. ( )	14. ( )	22. ( )
7. ( )	15. ( )	23. ( )
8. ( )	16. ( )	24. ( )

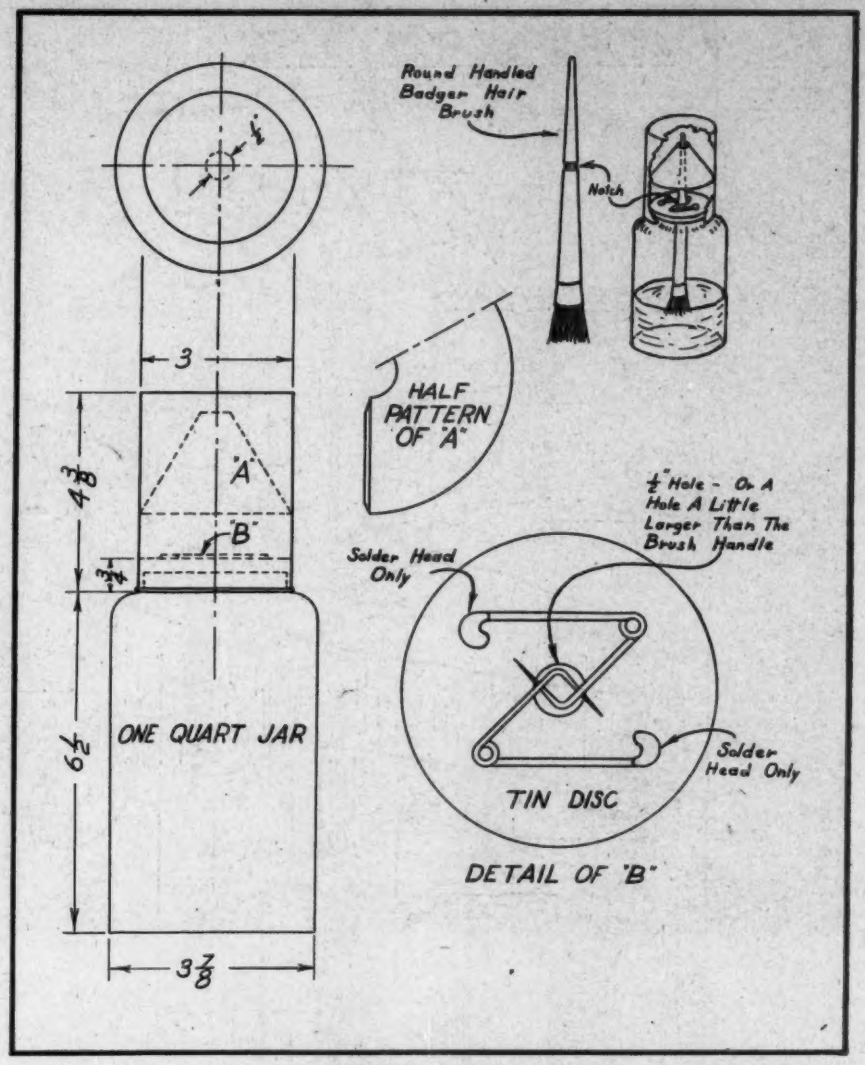
A LACQUER BRUSH HOLDER

FRANK C. CAMPBELL

Beacon, N. Y.

This lacquer and lacquer brush container has proved its worth in a general metal shop. It has made clear lacquer available for immediate application. The brush is suspended in the liquid making it unnecessary to clean it after it has been used. The saving in lacquer and lacquer thinner has more than paid for the time and effort spent in making the holder.

Other advantages are that the amount and purity of lacquer is visible at all times and the brush is quickly and easily hung. Also, if a thin layer of lacquer is brushed around the edge of the can where it contacts the glass jar, it will form an airtight seal which is easily broken and which practically eliminates evaporation.



Lacquer brush holder

To make this brush holder, select a tin can, or make one, that makes a reasonably firm seat on the shoulder of a glass jar. The can and jar should be of such a length as will permit the brush to hang at a reasonble height in the jar.

Make a funnel shaped piece *A*. Fit and then solder it in place. It serves to keep the brush straight.

Cut disk *B* to fit just inside the can. Punch out its center hole a little larger than the largest part of the brush to go through it.

Select two good safety pins large enough to fit the size brush you wish to hold and bend them as indicated in the plan. Put one in position and solder its head in place. Interlock the point of the second pin with the first pin as indicated and solder its head in place. It may be necessary to put a slight offset in the pins between their bends and their points to make them work under one another properly. It may also be necessary to resolder the heads in a slightly different place so that the pins have the proper tension and their bends are in the proper position.

Solder the disk *B* into the can, pins inside. Be careful not to use too much heat near the pin heads.

Complete the job by cutting a small notch around the brush at the proper height.

TECHNIQUES IN USING DRILL PRESS

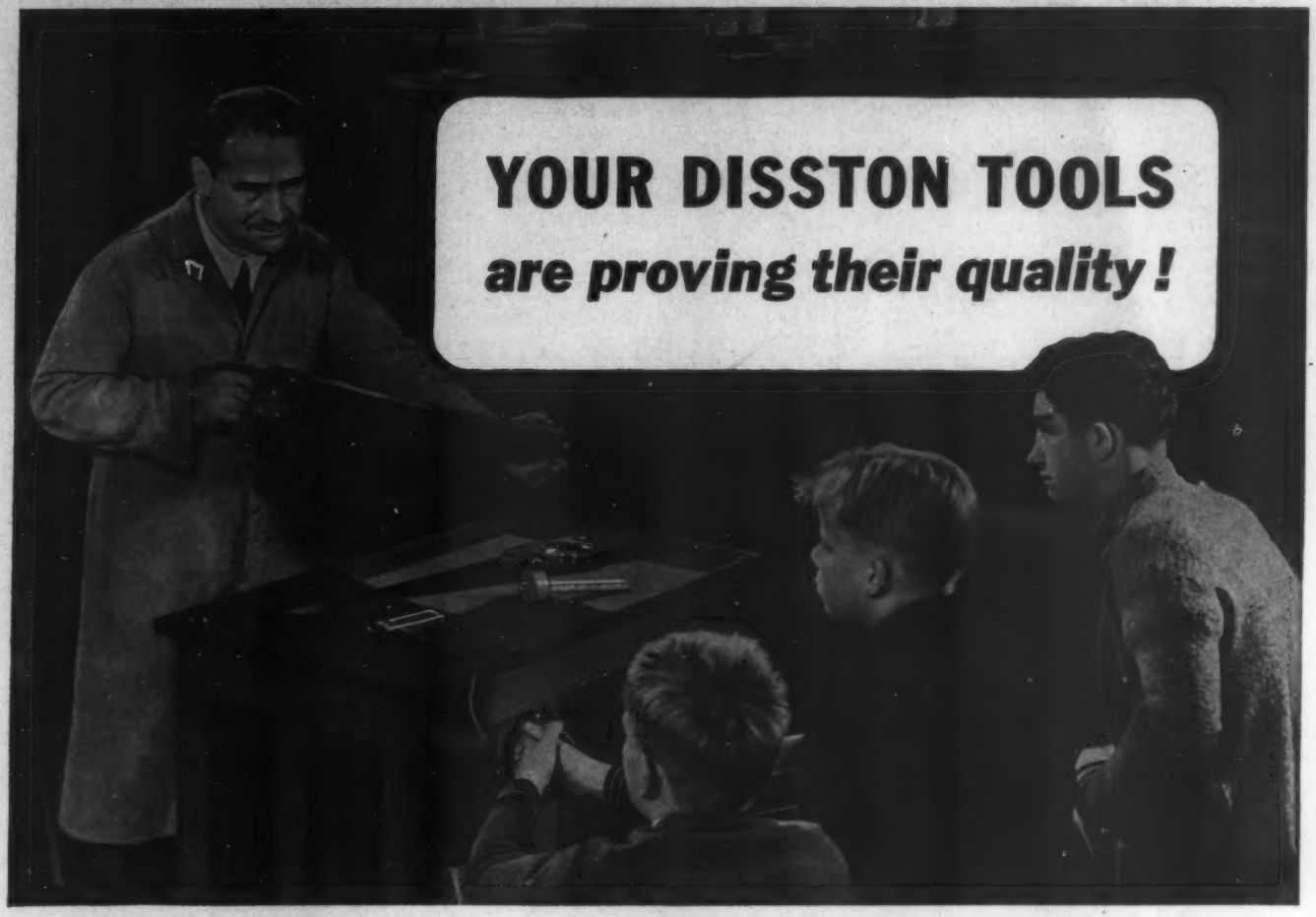
JOHN McINNES

Bremerton, Wash.

Names of Parts of Drill Press

1. Head
   - *a*) Pulley
   - *b*) Spindle
   - *c*) Spindle clamp
   - *d*) Depth gauge
   - *e*) Feed handle
   - *f*) Feed return spring
   - *g*) Jacob's chuck
   - *h*) Jacob's chuck wrench
   - *i*) Belt and spindle guard
2. Motor
   - *a*) Motor
   - *b*) Variable speed pulley
   - *c*) Motor belt tightener
   - *d*) Variable speed pulley belt tightener
3. Table
   - *a*) Table clamp
   - *b*) Table tilting clamp
4. Column 5. Floor table 6. Drills 7. Vise

(Continued on page 22A)



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• For your classroom and workshop use, Disston also supplies, *without charge*, educational charts and other material. Write today.

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(Continued from page 438)

Drilling Metal

1. Center punch at point where hole is desired.
2. If drilling through stock, make sure that drill will go into hole provided for it in table.
3. Be sure drill is clamped tightly in chuck.
4. Clamp small, round, or irregular shaped work in vise.
5. Adjust for proper speed for work.

Mortising

1. Parts of attachment
   - *a*) Chisels
   - *b*) Bits
   - *c*) Hold-down and guide
   - *d*) Chisel holder
2. Manipulation
   - *a*) Check to be sure that bit is set in chisel properly.
   - *b*) Check for proper speed.
   - *c*) Set depth of cut adjustment, except in case of through cuts.
   - *d*) On through cuts, provide waste stock for chisels to run into to prevent splintering.
   - *e*) Check to be sure table is tightly clamped at proper height.
   - *f*) Do not cut too slowly as this will cause bit to heat in the wood.

Shaping

1. Parts of attachment
   - *a*) Adapter
   - *b*) Table
   - *c*) Guide and guard attachment
   - *d*) Cutters
2. Manipulation
   - *a*) Check for proper speed.
   - *b*) Check for properly clamping adapter in place.
   - *c*) Try cut in waste stock for proper adjustment of table and guide.
   - *d*) In places where end of cut comes across end grain, follow up with piece of scrap to prevent splitting of corners.
   - *e*) On curved cuts remove guide, set pin in table to feed against, and using piece as a lever, feed stock into place for desired cut. In this kind of cutting a depth collar must always be used, if possible, to prevent irregular depths of cut.

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Personal News

COMMISSIONED LIEUTENANT (jg)

Dewey F. Barich, head of the industrial-arts department of Kent State University, Kent, Ohio, has received a commission in the Navy

Dewey F. Barich

Reserves as Lieutenant (jg), and will receive his indoctrination training at Princeton University.

Kent State University has granted him a leave of absence for the duration.

♦ Howard E. Hedinger, formerly of the Sharpsville High School, Sharpsville, Pa., where he planned and set up the industrial-arts department in 1940, is now employed by the Ford Trade School at the Ford River Rouge Plant. He is helping to set up a new course for metal smiths and ship fitters with the assistance of Hugh B. Reid and Walter Siera.

Mr. Hedinger has charge of the Applied Mathematics, Forging, and Pipe-Fitting units.

Mr. Reid is in charge of the layout drafting and ship construction drawing. He served his apprenticeship in the shipyards in Scotland. After coming to this country he worked for about 18 years as a metal smith and ventilation expert for the Ford Motor Company. In addition he also acted as evening school instructor in sheet-metal layout at the Wilber Wright Vocational School, Detroit, Mich., for the past seven years. Mr. Reid is also the author of a new book on sheet-metal layout.

Mr. Siera, a former high school shop instructor at Hamtramck High School, Detroit, Mich., and also a teacher at the Great Lakes and Norman Naval Training schools, has charge of small tools, metallurgy, and welding instruction.

♦ Walter M. Arnold, Penn State, 1930 (M.S., 1935), has been elected director of vocational education at Allentown, Pa. Previous to this he was on the staff of the United States Office of Education.

(Continued on page 24A)

Free—this valuable Delta book

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(Continued from page 22A)

♦ Dr. F. Theodore Struck is assisting in the review of definitions in the area of "vocational education" for the *Dictionary of Education* sponsored by Phi Delta Kappa. Carter V. Good, of the University of Cincinnati, is chairman of the Dictionary Committee.

♦ W. H. Wagner, formerly teacher of industrial arts at Kansas City, Mo., has been appointed teacher of engineering drawing in the Navy V-12 program, Central Missouri State Teachers College, Warrensburg, Mo.

Mr. Wagner received the M.A. degree at the University of Missouri last summer.

♦ Anthony J. Scholter, formerly personnel officer of the NYA at Milwaukee, has been appointed vocational adviser in the vocational rehabilitation division at the Veteran's Administration, Wood, Wis.

♦ Kurt Meyer, formerly a teacher in the Chicago school system, is now teaching radio and electricity at the Maine Township High School at Des Plaines, Ill.

James Pendleton is teaching in the machine shop.

♦ Albert O. Remde, formerly the drafting instructor at Hubbard, Ohio, High School, has been in charge of the drafting and blueprint reading course for machinist's mates at the Dearborn Naval Training Station for the past year. He is assisted by four instructors and a draftsman.

♦ Ira Noble has been appointed instructor of electrical trades at Argentine High School, Kansas City, Kans.

♦ Lt. Commander C. C. Caveny of the Navy Pier, Chicago, who is on leave of absence from his position as Area Co-ordinator with headquarters at the Pennsylvania State College, visited his Alma Mater recently.

♦ Mr. Edward K. Hankin, co-ordinator, Bok Vocational School, Philadelphia, is on leave of absence from his job to complete his degree requirements at the Pennsylvania State College.

♦ F. Theodore Struck has recently been notified of his election as a member of the National Panel of Arbitrators for the American Arbitration Association.

♦ W. E. Simpson has been appointed local director of the distributive education evening program at Salina, Kans.

♦ M. T. Coulson has been appointed local director of the vocational evening school program at Great Bend, Kans.

♦ Homer C. Rose, formerly connected with the Teacher Training Department, Armored School, Fort Knox, Ky., has recently entered the U. S. Army.

♦ Roy E. Howard has assumed duties with the Executive Training Department of the General Motors Institute at Flint, Mich. He had until recently been a teacher at the Armored School Teacher Training Department, Fort Knox, Ky.

♦ Albert (Pat) Welch, 79, a member of the printing department of the Milwaukee Vocational School, Milwaukee, Wis., for 13 years, died October 16, 1943, at his home in West Allis.

Mr. Welch was born in Lammer, Cornwall County, England, and was brought to this country in 1871. He entered the printing trade on the Port Huron (Mich.) *Daily Times* in 1882, and in 1885 he joined the Typographical Union at Detroit. He was a member of this union for 54 years.

In 1891 Mr. Welch came to Milwaukee where he served as secretary of the Typographical Union for several years, was a member of the state federation of labor executive board, and was an officer of the Allied Printing Trades Council at one time.

He is survived by a son, Gerald P. Welch.

Having been poor is no shame, but being ashamed of it is. — *Benjamin Franklin.*

Association News

AMERICAN VOCATIONAL ASSOCIATION CONVENTION

The thirty-seventh convention of the American Vocational Association will be held in Chicago on December 15, 16, and 17 at the Morrison Hotel and the Palmer House.

Arrangements for the convention are in the hands of Dr. William H. Johnson, superintendent of Chicago schools, who is the chairman of the local executive committee. Philip L. McNamee, assistant superintendent of Chicago schools, is cochairman. The remaining members of the executive comimttee are Dr. Louis V. Newkirk, Chicago director of industrial-arts education; Urban G. Willis, principal of the Pullman Free School of Manual Training; J. E. Hill, Illinois state supervisor of agricultural education; Henry H. Hagen, Chicago district superintendent of high schools; Dr. Sophie Theilgaard, principal, Flower Technical High School; and Charles E. Lang, principal, Lane Technical High School.

Fred A. Smith, president of the American Vocational Association, announces that this year's convention will be "A War Work Vocational Conference," having as its theme "Gearing Vocational and Practical Arts Training to War and Postwar Needs."

The meetings of the State Directors will be held at the Palmer House on Monday and Tuesday, December 13 and 14. The Industrial Education Section meetings will be held at the Palmer House on Wednesday, December 15, and at the Morrison Hotel on Thursday afternoon and Friday forenoon, December 16 and 17. The

(Continued on page 26A)

PROUD OF HER SERVICE UNIFORM

She won top honors in her class. Voted the "best dressed", too. Today, her attire is different. But the qualities that put her in highest position—character and leadership—are more outstanding than ever before. Plumb, too, dons a service uniform. In time of war, Government limitations have taken some of the glisten and polish from the tools. But the qualities that for almost a century have placed Plumb foremost among fine tools are unchanged. The one-piece head of flawlessly-tempered steel—the tested hickory handle—the perfect hang, design, and balance—these are the features by which you can now, as always, judge Plumb. Plumb is proud of its service uniform. Fayette R. Plumb, Inc., Phila. 37, Penna.

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TOOLS ARE VITAL FOR VICTORY
BUT ONLY WHERE VITALLY NEEDED

(Continued from page 24A)

Agricultural Education Section will meet at the Palmer House throughout the convention.

The main themes of the four industrial-arts programs are as follows:

Planning for Post-War Industrial Arts, with V. L. Pickens, supervisor of industrial arts, Kansas City, Mo., as chairman.

The Effects of Present School War Programs of Industrial Arts, with R. B. McHenry, director, industrial and adult education, Tulsa, Okla., as chairman.

The Use of Visual Aids and Special Devices in the Teaching of Industrial Arts, with Chairman Clyde A. Bowman, dean, division of industrial education, The Stout Institute, Menomonie, Wis., in charge.

Closer Linking of Industrial Arts and Vocational Industrial Education, under the chairmanship of Dr. Homer J. Smith, professor of industrial education, University of Minnesota, Minneapolis, Minn.

♦ In 1918, when Cleveland's public schools were having difficulty in getting industrial-arts teachers, Charles H. Lake, then principal of East Technical High School, interested eleven 18-year-old boys in the twelfth grade in taking a short course to fill some of the vacancies.

In September of that year they finished the course and began the task of teaching.

On October 2, 1943, with Mr. Lake now superintendent of schools, 9 of the 11 celebrated the completion of a quarter of a century of teaching by having lunch in Hotel Auditorium.

There was no formality. The ten sat down together and while they ate reminisced about what had happened in the days since 1918.

Mr. Lake said that William Roberts, then director of industrial arts in the public school system, first had the idea of a short course to qualify youths for teaching positions in the industrial-arts shops at a time when World War I had cut deeply into the ranks of instructors. He took the idea to Lake, who cooperated and aroused the interest of the 11 youths.

Standing, left to right: Hyman Fine, Carl D. Eckley, Daniel E. Schiely, Joseph H. Mulac, Ray N. McFarlin, Sylvester R. Pfromm, and Louis J. Lenc. Sitting, left to right: Max R. Klein, Supt. Charles H. Lake, and Leslie J. Frye

The 11 are Carl D. Eckley of Addison Junior High School; Hyman Fine of Harvard School; Leslie J. Frye, supervisor of industrial arts; Max R. Klein, director of the Educational Museum; Louis J. Lenc of William Dean Howells Junior High School; Joseph H. Mulac of William Rainey Harper School; Ray N. McFarlin of Lincoln High School; Sylvester R. Pfromm of Oliver Hazard Perry School; Daniel E. Schiely of Central Senior High School; Samuel H. Cohen of Boulevard School; and Harold Melrose of Audubon Junior High School. Cohen and Melrose did not attend the luncheon.

These men, of course, did not limit their training as teachers to the short course 25 years ago. In the years since they have completed college courses and otherwise fitted themselves for the profession.

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News Notes

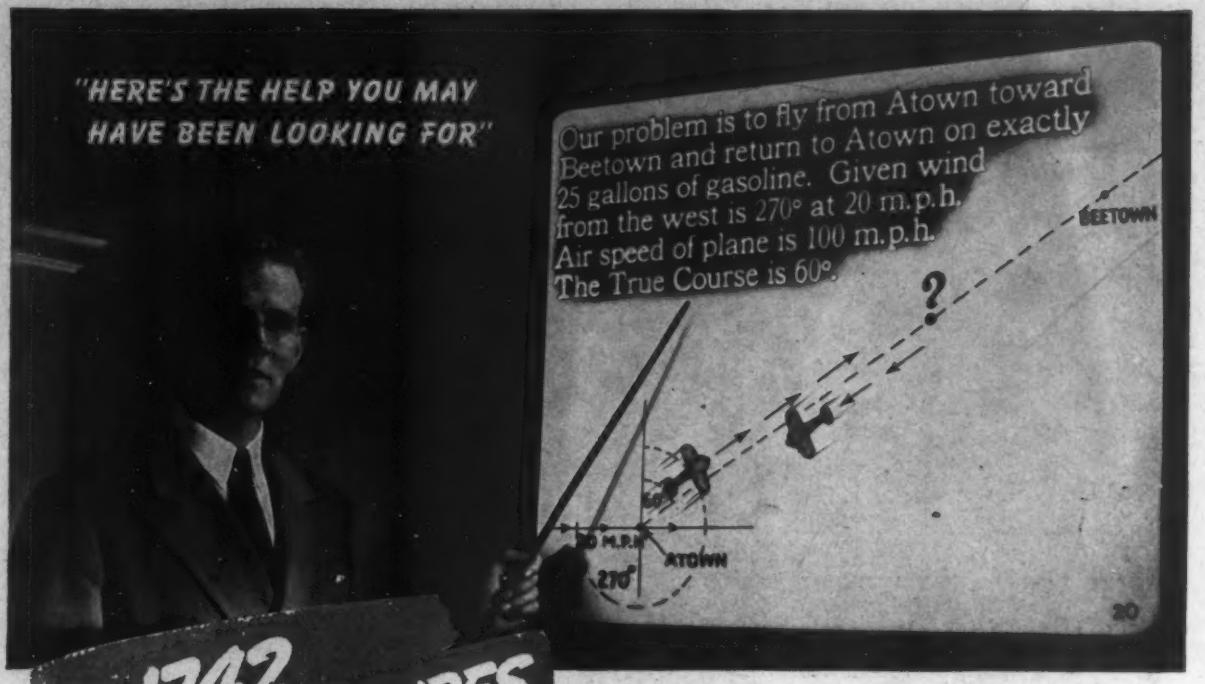
TO RESHAPE TECHNICAL TRAINING

Appointment of a consulting committee on vocational technical education to help solve problems caused by rapid changes in the technical aspects of industry and by the increasing demand for trained technicians was announced recently by United States Commissioner of Education John W. Studebaker.

The chairman of the newly appointed committee is J. C. Wright, assistant United States commissioner for vocational education of the United States Office of Education. Prof. Lynn A. Emerson of Cornell University is the secretary.

Other members include: SOLOMON BARKIN, director of research, Textile Workers Union of America; M. R. BASS, director, School of Mechanical Trades, St. Louis, Mo.; M. M. BORING, General Electric Company, Schenectady; HOWARD CAMPION, assistant superintendent in charge of vocational education, Los Angeles; LIEUT.-COMMANDER JAMES R. COXEN, Shore Establishments Division, United States Navy; L. H. DENNIS, executive secretary, American Vocational Association; L. J. FLETCHER, director of training, Caterpillar Tractor Company, Peoria, Ill.; OAKLEY FURNEY, assistant commissioner for vocational education, Albany, N. Y.; H. P. HAMMOND, dean of engineering, Pennsylvania State College; A. C. HARPER, president, Polytechnic Institute, Wyomissing, Pa.; A. S. HAWKINS, chief of trade and in-

(Continued on page 29A)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Our problem is to fly from Atown toward Beetown and return to Atown on exactly 25 gallons of gasoline. Given wind from the west is 270° at 20 m.p.h. Air speed of plane is 100 m.p.h. The True Course is 60°.
BEETOWN
?
ATOWN
270°
20

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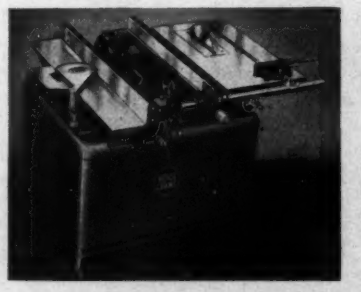

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(Continued from page 26A)

dustrial education service, United States Office of Education; M. H. HEDGES, director of research, International Brotherhood of Electrical Workers of America; ARTHUR A. HOOD, chairman of the Producers Council Committee on Postwar Marketing and director of dealer relations, Johns-Manville Corporation; F. J. KELLY, chief of the higher education division, United States Office of Education; B. F. KYKER, chief of the business education service, United States Office of Education, Washington, D. C.; KARL LARK-HOROVITZ, Purdue University; JOHN A. MC CARTHY, assistant commissioner in charge of vocational education, Trenton, N. J.; CLARENCE E. RAKESTRAW, consultant, employee-employer relations, United States Office of Education; WILLIAM F. RASCHE, director, Milwaukee Vocational School; E. F. RILEY, president, School of Science, Wahpeton, N. Dak.; ROBERT H. SPAHR, General Motors Institute, Flint, Mich.; JESSE W. STILLMAN, du Pont Experiment Station, Wilmington, Del.; J. RAYMOND WALSH, director of research, C. I. O. headquarters, Washington, D. C.; ROBERT J. WATT, international representative, American Federation of Labor, Washington, D. C.

♦ Draftsmen are being sought by the U. S. Civil Service Commission for work in federal agencies in the prosecution of the war. Entrance salaries range from $1,752 to $3,163 a year, including pay for the eight hours of overtime incorporated in the 48-hour federal work week.

Draftsmen of all types are needed, particularly ship, electrical, and mechanical draftsmen, as well as topographic draftsmen.

Qualified engineering draftsmen in any field are urged to apply, but persons without previous experience in the fields where needs exist may be appointed and trained in the subject. Women are especially desired.

Interested persons may secure Announcement 283 and application forms from first- and second-class post offices; from Civil Service regional offices in regional headquarters' cities; or from the U. S. Civil Service Commission. Applications should be sent to the U. S. Civil Service Commission, Washington 25, D. C.

♦ A new set of 21 2 by 2-in. Kodachrome slides of the flags and emblems of the American Republics has been announced by the Society for Visual Education, 100 East Ohio St., Chicago 11, Ill. The flag and emblem of one Republic appear on the same slide, both in true natural color. In addition, there are Kodachromes of the American and British flags silhouetted against the sky; a close-up of the American flag; and one of it billowing in the wind from an eagle-tipped flagpole.

These natural color slides are especially interesting in the study of all the American Republics and are available at 50 cents each. A complete list will be furnished free on request.

♦ The Pre-Induction Training Section of the War Department and the U. S. Office of Education have cooperated in reviewing, selecting, and listing visual training aids for preinduction courses. The various slide-film and motion-picture producers and distributors are assisting in making this list available to all schools. In the meantime, the Society for Visual Education, Inc., has prepared a special list of the S.V.E. slide films, selected for P.I.T. courses. The list is available for free distribution.

The S.V.E. list includes several subjects in each of the following fundamentals: preflight, physical fitness, electricity, radio, machines, shopwork, and automotive mechanics. The list also includes three new slide films on job opportunities in the military and maritime services, and three in elementary meteorology, which are in great demand among schools.

Copies of the printed folder, "Slidefilms for Pre-Induction Training," may be secured from the Society for Visual Education, Inc., 100 East Ohio St., Chicago 11, Ill.

♦ A new set of twenty Kodachromes, "Highlights in the Life of Lincoln," complete with teacher's manual, has been announced by the Society for Visual Education, Chicago. Each Kodachrome — a 2 by 2-in. miniature slide — is a scene from the Lincoln Dioramas, which were executed by the Museum Extension Program of Illinois. These include subjects selected by the Chicago Historical Society in collaboration with a group of eminent Lincoln authorities.

A complete list of scenes and other pertinent information will be furnished upon request to the Society for Visual Education, Inc., 100 East Ohio St., Chicago 11, Ill.

♦ A sound motion picture which is to serve as a supplement to first-aid courses in schools, and to make for easier and more rapid instruction, has been produced by Johnson & Johnson, New Brunswick, N. J., in cooperation with the United States Public Health Service. This picture was designed to encourage the splendid service of first aid throughout the country, and has been reviewed and passed by the United States Office of Civilian Defense and the American College of Surgeons. This film is entitled "Help Wanted." It may be shown only on a 16mm. sound projector and requires thirty minutes for showing.

Qualified schools or other groups interested in securing prints of "Help Wanted" on a free-loan basis should communicate with Johnson & Johnson, New Brunswick, N. J., giving the date of the proposed showing.

♦ Teachers interested in high school aviation clubs will be interested in the Teacher's Kit of Aviation Materials for Junior and Senior High Schools.

Information about this kit may be obtained by writing to United Air Lines School and College Service, Room 305, Palmer House, Chicago 3, Ill.

New Publications

Industrial Electricity and Wiring

By James A. Moyer and John F. Wostrel. Cloth, 541 pages, 5¾ by 8¼ in. Price, $2.75. The McGraw-Hill Book Co., New York City.

This is the third edition of this book. The new revision brings the book up to date with respect to changes made in the wiring regulations and in the National Electrical Code.

A chapter on fluorescent lighting also has been added.

Essentials of Drafting

By Carl Lars Svensen. Cloth, 295 pages, 7⅛ by 9¾ in., illustrated. Price, $2.35. Published by D. Van Nostrand Co., Inc., New York, N. Y.

This is the third edition of this book. The material has been rewritten, the page size enlarged, and new problems have been provided.

The appendix contains many useful tables.

Popular Mechanics Photo Guide

Cloth, 188 pages, 6½ by 9½ in. Price, $1.25. Popular Mechanics Co., Chicago, Ill.

A book filled with numerous kinks for doing the outstanding in the fields of indoor and outdoor photographing.

Teaching Techniques in The Armored School

Vol. 1. Principles of Learning and Analysis of Subject Matter. Paper, 40 pages, 7¾ by 9¾ in., illustrated.

Vol. 2. Teaching Techniques. Paper, 85 pages, 7¾ by 9¾ in., illustrated.

Vol. 3. Principles of Evaluation. Paper, 61 pages, 7¾ by 9¾ in., illustrated.

The material contained in these three volumes was prepared by members of the teacher-training staff of the Armored School at Fort Knox, Ky., who used it in their own classes in preparing officers, enlisted men, and civilians so they could carry on the work of instructing others.

Painting, Furniture Finishing and Repairing

Cloth, 96 pages, 6⅝ by 9½ in., illustrated. Price, $1.50. Popular Mechanics Press, Chicago, Ill.

A compilation of many helpful hints and kinks on how to use the many different types of finishing materials, how to prepare the surfaces to be finished, and how to clean the brushes that are used in applying shellac, paint, enamel, calcimine, lacquer, varnish, and the like.

Junior Printing

By Clifford K. Lush. Paper, 64 pages, 7½ by 10½ in., illustrated. Price, 51 cents. The Manual Arts Press, Peoria, Ill.

A workbook which presents material that will be helpful to students of printing no matter what textbook they may regularly use in their study of the graphic arts.

Metalwork: Technology and Practice

By Oswald A. Ludwig. Cloth, 397 pages, 8 by 10¼ in. Price, $4. McKnight & McKnight, Bloomington, Ill.

A book that is profusely illustrated and that explains many of the processes used in the metalworking trades. It emphasizes the informational side of the machine-shop trades, automotive and aeronautical work, metal patternmaking, foundry work, sheet-metal trades, metal building trades, ornamental metalwork, and electrical trades.

Fundamentals of Industrial Arts and Vocational Education

William H. Johnson and Isadore M. Fenn. Leatherette binding, 138 pages, 5⅜ by 7¾ in., illustrated. The Goodheart-Wilcox Co., Inc., Chicago, Ill.

A useful manual for teachers of industrial arts and vocational education which answers numerous questions about their particular field of education.

The material is presented in the form of questions and answers, with comments by the authors and references to a list of selected references.

The subject matter has been divided into: historical development; federal aid to education; philosophy; curriculum; organization, management, and supervision; shop organization and management; method; psychology; tests and measurements; vocational guidance; and modern trends.

Mathematics Dictionary

Compiled and edited by Glenn James, assisted by Robert C. James. Cloth, 281 pages, 6½ by 9¼ in. Published by The Digest Press, Van Nuys, Calif.

Definitions of mathematical words and phrases used in elementary, secondary, and college or university mathematics.

The book also contains many formulas. A number of helpful mathematical tables have been added to the book in the form of a 22-page appendix.

Airplane Hydraulic Systems

By Hugh C. Aument. Cloth, 120 pages, 5½ by 8¼ in., illustrated. Price, $2.25. The Ronald Press Co., New York City.

The authors of this book have tried to give a simplified approach to the study of the hydraulic equipment which is used in an airplane. The purpose of the book is to furnish this information in such a way that the men who must know how to use and maintain this equipment can be trained in the briefest possible time.

Aircraft Production Standards

Compiled by Stuart Leavell and Stanley Bungay. Loose leaf, imitation leather, 264 pages, 4⅝ by 7¼ in., illustrated. Price, $1.50. Published by McGraw-Hill Book Co., New York City.

(Continued on page 32A)

Filing Hints to meet war-time needs

HELLER MADE IN U.S.A.

Protect YOUR FILES WHEN NOT IN USE

A FILE is a cutting tool. Unless it is carefully handled and safely stored, it will not give the service of which it is capable. Beginners should be particularly instructed in how to protect files when not in use.

Do not permit files to be tossed into a drawer, left on a bench, or thrown together with other tools. If this is done, the file's keen cutting edge will be damaged. Good practice is to keep files separated, either by standing them with their tangs in holes in a file box, or by hanging them in a rack. Or, they may be kept in conveniently partitioned wooden receptacles. New files should always be left in their protective wrappings or original boxes until used.

☆ ☆ ☆

AS THEIR NAME implies, NUCUT Files make possible a new standard of cutting efficiency in shaping and finishing metals and other materials. The patented "WAVY TEETH" design, incorporating a scientific balance of coarse teeth and fine teeth precisely positioned in wavy rows, assures faster, better filing with less effort.

Wrong: Throwing files together or with other tools results in dull teeth and often breakage.

Right: Keep files separated. You can easily do this by hanging them in racks *(above)* or placing them in wood partitions *(below)*. Either way affords good protection.

HELLER BROTHERS COMPANY • Newark, N. J. • Newcomerstown, Ohio

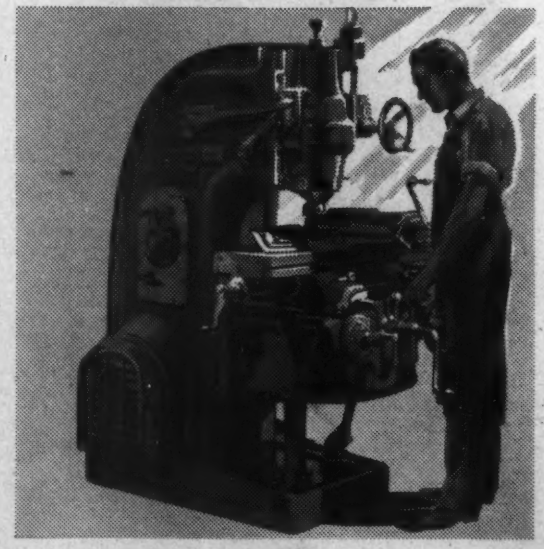
America's Oldest File Manufacturers—Good Tools Since 1836

Awarded to the Newcomerstown, Ohio, Plant

HELLER NUCUT WAVY TEETH FILES

PATENT No. 2027039

That the Brave May Return to the Land of the Free



We work and fight for our survival and destiny as a free land in a free world.

This is our creed — the source of our will-to-win and the indomitable spirit that leads us to Victory.

When the forces of aggression are destroyed and freedom no longer menaced, the ingenuity and capacity learned in the hard school of war can turn to the tasks of peace. The rebirth of free enterprise will set new standards of living — provide plenty for all.

For the ability of America's industrial leaders to unite precision — speed — and mass production — to explore new paths in technology and invention — while building weapons of war — is in itself the forecast of a better world to come.

The machine tools we build here at Kearney & Trecker to speed the production of armament today, and the new machines still on drafting boards, will contribute their part to the more abundant life to come.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WISCONSIN

"Buy Victory with War Bonds"

Milwaukee **MACHINE TOOLS**

(Continued from page 30A)

A handy reference book for those engaged in aircraft production. The subject matter is presented under the following headings: materials, inspection, assembly and installation methods, standard parts and design standards, manufacturers' standards, and reference tables and charts.

Popular Mechanics Shop Notes

Paper bound, 220 pages, 6½ by 9⅛ in. Price, 50 cents. Popular Mechanics Press, Chicago, Ill.

This is Popular Mechanics annual collection of workshop hints for the homecrafter, the model maker, and the shopworker who is on the lookout for new ideas.

(Continued on page 40A)

Shop Equipment News

New Products — Publications

NEW PLANER

A new 12 by 4-in. thickness planer has been produced by Boice-Crane Co., 932 Central Ave., Toledo, Ohio. It planes the hardest, also the brashy, splintery varieties of woods down to veneerlike thickness, ready to finish without sanding, and stock as short as 6½ in. The planer is of heavy construction, and the action is smooth and quiet. Large gears and ball-thrust bearings and oversize table lifting screws are used. Two idler rolls mounted on adjustable journals provide a steady powerful feed, which can be changed from a featherweight touch to a bulldog grip. The feed also can be stopped instantly without stopping the power source. Bench or floor-type models are available with a choice of direct to cutterhead drive, V-belt electric motor drive, or drive from lineshaft or gasoline engine.

12 x 4-in. planer

For brief reference use IAVE—1001.

POST'S WEEKLY CALENDAR

Following the recommendations made by draftsmen and engineers, the new Post 1944 Weekly Calendar has two big advantages over the extremely popular Post 1943 Calendar, namely, the giant weekly dates placed on one line for easier reading, and the inclusion of a large monthly calendar on each sheet. In addition, there is a section of technical data for the

(Continued on page 34A)

Handy weekly calendars

One of 44 Bradley Washfountains in Hershey, Pa. Industrial School.

PROPER WASHING IS ESSENTIAL TO GOOD WORKMANSHIP

In the many schools, colleges and institutions, where modern Bradley Washfountains are installed—instructors consider good washing facilities important for two reasons.

FIRST, because good workmanship in the industrial and shop departments includes care of tools, orderliness and cleanliness.

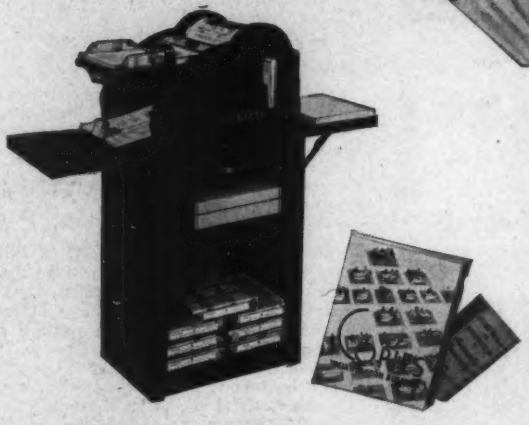
SECOND, sanitary washing facilities reduce chance of skin affections.

Bradley Washfountains encourage regular washing—clean *running* water is furnished each student—no contaminating water collects, for the bowl is self-flushing. Bradleys provide more facilities in a given space,—8 to 10 wash simultaneously. Less water is consumed and only one-fifth as many piping connections are required because each Bradley takes the place of 8 to 10 "single-person" wash basins . . . Recommendations by our Washroom Consultants and copy of our Catalog 4308 are yours for the asking . . . BRADLEY WASHFOUNTAIN CO., 2269 W. Michigan Street, Milwaukee 1, Wis.

BRADLEY Washfountains

New Catalog 4308 will be mailed on request

BEFORE THIS BOMBER BLASTS...



Write for new teaching idea samples. They will show you how to make even greater contributions to the war effort.

DITTO

Trade Mark Reg. U. S. Pat. Off.

Before any Fortress takes the air, before any ship slides down the ways, before a bomb is dropped or a gun is fired—Industry must have trained minds and hands to create the weapons of war! The greatest production schedule in history is urgently calling for capable men and women to achieve new degrees of efficiency! The demands of War Production have supplied new proof of DITTO'S manifold versatility—of DITTO'S extraordinary speed and error-proof accuracy!

DITTO HELPS TRAIN MINDS AND HANDS FASTER

DITTO instantly makes copies of anything written, printed or drawn—in one to five colors at once—without stencil, type, ink or carbon. Let *your* students use DITTO. Let them become thoroughly familiar with this most modern tool of industry and business. You'll find DITTO will help you turn out trained men and women faster.

Today as always genuine Ditto supplies are available for keeping previously purchased gelatine and liquid type machines operating at top efficiency.

DITTO, INC.

2246 W. Harrison Street, Chicago 12, Illinois

(Continued from page 32A)

engineer and draftsman, such as charts on wire and sheet-metal gauges, screw threads, etc.

The top illustration is printed in six colors, and portrays the dream of many a schoolboy — that of becoming a designing engineer.

Requests should be addressed to The Frederick Post Company, Box 803, Chicago 90, Ill.

For brief reference use IAVE—1002.

BOOKLET DESCRIBING TEACHING AID

A 24-page booklet recently released by the Universal Scientific Co., Inc., 1102 Shelby St., Vincennes, Ind., describes the Crow Rotating Electric Machine.

This machine is a teaching aid which points out the differences in construction, theory, and operation of the various types of rotating electrical machines.

It is ruggedly constructed, yet so designed that the parts are accessible and visible. Its versatility becomes apparent when one considers that the machine can be used for demonstrating the various types of motors and generators, as a sine-wave device showing single-, two-, and three-phase current, as a rotary variable transformer, and as an induction feeder-regulator.

The same basic parts, consisting of baseboard, frame ring axle, bearings, and bearing supports are used in various combinations and positions to demonstrate all of the electrical devices mentioned.

For brief reference use IAVE—1003.

NEW PRECISION MACHINING METHOD

An interesting booklet describing the advantages of "Wet Belt" surfacers for precision grinding of metal parts has been recently issued by The Porter-Cable Machine Co., 1714 N. Salina St., Syracuse, N. Y.

This booklet describes how the wet abrasive belt eliminates heat and dust, how it can be used to supplement other machines in doing preliminary or final finishes, and how the coolant makes possible not only the stepping up of production but the maintenance of very close tolerances on all work done with metals, plastics, hard rubber, glass, tile, ceramics, fiber, marble, slate, wood, and bone.

The "Wet Belt" method also makes the use of expensive jigs, highly skilled operators, and costly dust removal systems unnecessary.

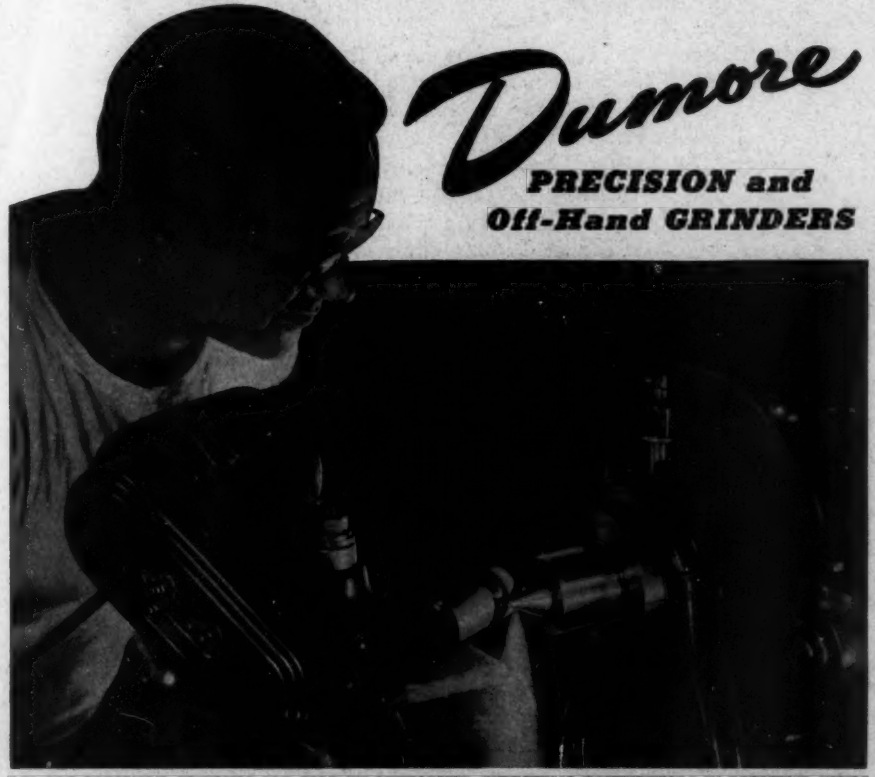
The booklet also contains descriptions of other dry and wet sanders and surfacers manufactured by this firm.

For brief reference use IAVE—1004.

TRAIN THEM IN PRECISION

for Today...and for Tomorrow!

Industry's standards of precision raised to new levels by war production requirements will be reflected in innumerable manufactured products for peace time use. Dumore Precision Grinders have provided thousands of shops a means to meet the requirements of war production, and are familiarizing workers with the use and care of a precision tool. Mounted on lathe, planer, miller, or any available base, it converts that machine to a precision grinder capable of a wide range of internal or external grinding to .0001" tolerances. Catalog 42 describes seven models and fifty-four quill combinations. Glad to send a copy for the asking. The Dumore Company, Grinder Division, Racine, Wis.



DUMORE PRECISION GRINDERS ARE SOLD BY AUTHORIZED INDUSTRIAL DISTRIBUTORS IN PRINCIPAL CITIES

AN INTERESTING BOOK ON THE DRILL PRESS

A new booklet entitled "19 Unusual Uses for Your Drill Press or Lathe" has been published by the Jacobs Manufacturing Co., Hartford, Conn.

It gives explicit directions on how to handle a wide variety of work with limited power equipment. Detailed illustrated information shows how to make the setups, and what attachments and accessories are used. In some instances, the book explains how to make the accessories themselves.

Printed in color and containing 49 illustrations, it gives practical, helpful data of interest to all who have shops, or are planning postwar shops. It is available at a cost of 10 cents to cover handling and postage.

For brief reference use IAVE—1005.

FOLDER ON GRAPHIC-ARTS EQUIPMENT

American Type Founders, Elizabeth 3, N. J., has just issued an interesting folder for graphic-arts teachers.

It covers art-type designs, including the popular ATF "Alpha-blox," rubber plate kits, linoleum block kits, silk-screen units, art proof presses, bookbinding units, and other similar equipment. One item which cannot fail to have great appeal to printing and art teachers is a font of type characters called "Alpha-blox," that can be formed into unique letter combinations of almost unlimited number and range of style. Printing and art teachers will find that these unique letter combinations will challenge the ingenuity of any serious student. This folder, showing many examples of Alpha-blox designs, is issued by the Department of Education, American Type Founders, Elizabeth, N. J., and will be mailed without charge to any printing or art teacher requesting a copy.

For brief reference use IAVE—1006.

METAL PREPARATION PRIOR TO FINISHING

Information Sheet No. 7, describing the necessity of carefully preparing metal surfaces before any coating of lacquer, varnish, or other finishing material is applied, has been issued recently by the Behr-Manning Corporation, Division of Norton Co., Troy, N. Y.

This instruction sheet gives precise information on both mechanical and hand sanding, the types of coated abrasive to use, and the forms in which these may be obtained.

A number of questions for discussion have been appended to the sheet.

For brief reference use IAVE—1007.

VISUAL AIDS CATALOG-DIRECTORY

A new type of visual aids catalog-directory on "Slidefilms and Motion Pictures to Help Instructors," is announced by The Jam Handy Organization, 2900 East Grand Blvd., Detroit (11), Mich. It will be sent free on request to any teacher, school, college, or educational group.

The new system of indexing, cross-indexing, and classifying, assists the teacher to locate, by the mere flip of the page, any of the many slide films and motion pictures used in a wide range of studies.

This catalog-directory is printed in colors, comprising 80 pages of detailed information, including the number of "frames" or pictures in each slide film and in each series.

For brief reference use IAVE—1008.

NOW is the time to plan your MODERNIZING!

The more efficient, the newer and fresher your equipment, the keener will be the appeal of your Printing Department to the greater number of students.

And... increased enrollment in your department best reflects *your leadership!*

Does your proof press operate cleanly? Why not plan to install a Vandercook Precision Proof Press that *does?*

Why not trade in your old stands for new Hamilton Type Cabinets of hardwood construction? They will give the desired "face-lifting" to your whole printing department. And you can obtain these *NOW!*

Today "Modernization" is THE trend in every line of endeavor. Therefore the School, always the fount of advancement, should lead in Modernization. *And now is the time to make all your plans.*

Is your paper cutter provided with all safety devices? You should list in your plans a Challenge Cutter that *does* meet every safety requirement.

Are your Type Faces worn or outmoded? Add a few fonts of modern ATF designs *now,* and give your students extra zest in their work by using these new tools. *You can now purchase Type and Cabinets without restrictions.*

Free! Mail this coupon TODAY!

EDUCATION DEPARTMENT, AMERICAN TYPE FOUNDERS,
200 Elmora Ave., Elizabeth 3, N. J.

Without obligation on my part, I would like to receive your suggestions for Modernizing my Printing Department.

Particularly I want to know .....

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Name .....

School ..... Title .....

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Resistant to Alcohol, Cosmetics and Hot Dishes.

An Outstanding Quality Finish for Student Project Finishing in School Shops.

NO BRUSHES REQUIRED — 1c PER SQUARE FOOT — **NO RUBBING BETWEEN COATS**

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SEALACELL Never Raises the Grain of the Wood. Can Be Mixed With Ground in Oil Colors for Staining.

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Keene Cement Packed in 25, 50, and 100 lb. Cartons. Mineral Colors Packed in 4 and 9 lb. Containers.

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A new text called by instructors who have seen it the "best book published on printing." Each fundamental operation is illustrated by close-up illustrations. $1.60.

GENERAL DRAFTING

Fryklund & Kepler

Describes fundamental operations and tells how to perform them. Special units on electrical, sheet metal, radio, architectural drafting. $1.00.

GEN. SHOP WOODWORKING

Fryklund & LaBerge

A standard text for beginning students. Covers basic fundamentals in hand woodworking. Contains suggestions for designing practical projects. $ .80.

GEN. SHOP ELECTRICITY

Dragoo & Dragoo

A text embodying the fundamentals of electricity. Consists of wiring diagrams, circuit layouts, and other interesting electrical projects. $ .80.

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No. 23 Grinder

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Single or 3-phase geared motors operate spindles at just 500 r.p.m. 6" dia. x 2" face cup wheels—one fine, one coarse. Also high speed cone wheel for grinding gouges, and ½" high-speed wheel. Automatic coolant feed.

Here's the *safest* oilstone grinder for woodworking shops, —safe for tools, safe for the operator! Reduced wheel speed of 500 r.p.m. prevents burning of carbon steel used in fine hand tools, —also eliminates danger of flying emery and exploding wheels, common with cheaply-built high-speed units.

It's a Wallace quality-built product. Write today for bulletins —we also manufacture quality universal saws, jointers, bandsaws, lathes, mortisers, cut-off saws, glue pots, etc.

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Paramount Band Saws

Your students should be provided with *BAND SAW BLADES* which have been adopted as being able to stand the stiff requirements of War Production Plants.

Accurately made Band Saws of extreme toughness enables more work to be produced in less man hours.

All sizes are carried in stock for prompt shipment.

Exclusive Band Saw Manufacturers.

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ACCURATELY SPACED TEETH

NO CRUSHED POINTS - GUARANTEED

BURRILL SAW & TOOL WORKS

ILION, N. Y.

Carpenters Young and Old Prefer the "Greyhound"

Start your students out with the saw they will want when they become skilled craftsmen. For almost a century Ohlen-Bishop's fine hand saws have been the choice of men who take pride in fine tools. Master saw craftsmen, with years of experience, design, temper and grind these saws to the highest perfection. Try them — you'll say there's no equal.

Complete line of hand, circular and band saws shown in our new catalog No. 43 . . . write for it.

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MASTER SAW MAKERS SINCE 1857

TWO LOW COST

OLIVER

SCHOOL SHOP MACHINES

No. 194-B. BORING MACHINE

For drilling holes with neatness and dispatch, light in weight, perfectly rigid, all necessary quick adjustments, plus many unusual and important features, it is an "OLIVER" machine.

No. 194-D MORTISER

A simple, safe, durable and portable machine, designed and so constructed to take care of a wide range of projects.

Write and request circulars describing any woodworking machines in which you may be interested.

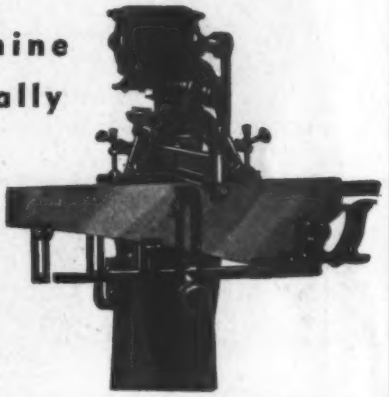
OLIVER MACHINERY CO.
Grand Rapids Michigan

DOUBLE
the Cutting Life of Your Saws!

Nothing is more important to the success of your training program than your saws. Students dull them fast—they need sharpening often.

With a Foley Automatic Saw Filer you can sharpen your saws more perfectly than is possible by hand. You can do it quicker,—and your saws will stay sharp longer. Your students will turn out better work with sharp saws. ALSO by keeping your saws sharp with a Foley,—you will easily double their cutting life and have less breakage, reducing replacements to a minimum.

ONE Machine Automatically FILES HAND... BAND... CIRCULAR SAWS



The Foley is the only machine that files and joints all hand, back and mitre box saws from 3 to 16 points per inch, cross-cuts circular saws up to 16" diameter (24" optional), and band saws up to 24' long. Patented jointing principle automatically evens up large and small teeth, so saws cut faster, truer, cleaner — stay sharp longer.

Train your students to file saws on a Foley, for they will find thousands of Foley Saw Filers used in industry, Army, Navy, Air Corps, etc. Hundreds of schools and colleges use them to save on saw filing costs and replacement expense.

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Use inexpensive staple tacks. List Price $6.00

STAR AUTOMATIC TACKERS

The Best Way to Tack Things

Used in industrial production work. Tack upholstery, wire screens, shades on rollers, dozens of other uses. Easy to operate—just squeeze the handle. Hold material in place with one hand, tack it with the other. Tack within 1/16" of an edge and in close quarters where you can't swing a hammer.

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A stapler and light tacker combined. Handy—fits in pocket. Squeeze it to staple papers—Holds 105 Standard Staples.

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Swing the base down and around and it becomes a light duty tacker. Fine for tacking up charts, pictures and papers on walls, drawings on drawing boards. List Price $1.90

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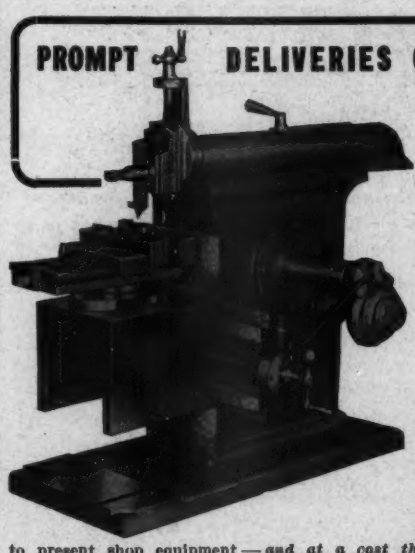

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The Lewis 10" Metal Shaper is only one project offering important advantages for wartime training classes. It is supplied as rough gray iron castings—with materials and blueprints. The students themselves complete the tool, receiving practical instruction in machine tool design, construction and operation. Once completed, the tool becomes a valuable addition to present shop equipment—*and at a cost that is surprisingly low.*

Find out *more* about Lewis Machine Tool projects—today! They are available under CMP regulation No. 5A, covering maintenance repair and operating supplies for educational institutions. *Catalog describing 23 items in complete detail will be mailed without obligation on request. Write for your copy today!*

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DI-ACRO BRAKE forms non-stock angles, channels or "Vees." Right or left hand operation. Folding width — Brake No. 1 — 6". Brake No. 2 — 12". Brake No. 3 — 18".

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With DI-ACRO Precision Machines, — Shears, Brakes, Benders, — you can give your students a valuable training in precision work at the same time you teach them the principles of shearing, braking and bending operations. With this method of "DIE-LESS DUPLICATING" all duplicated parts are accurate to .001".

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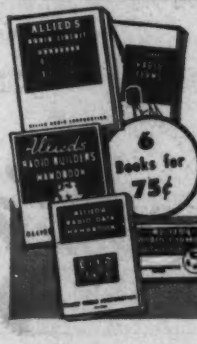

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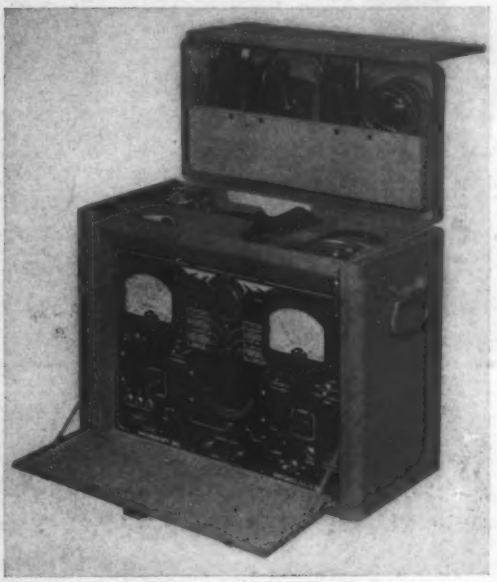

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Take exceptionally good care of all test leads. Keep them free from oil and grease.

If amperage or voltage is to be checked be sure to select a scale high enough so the meter will not be damaged.

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(Continued from page 32A)

Letters and Lettering

Designed by Paul Carlyle and Guy Oring; text by Herbert S. Richland. Cloth, loose leaf, 159 pages, 10½ by 8¼ in. Price, $4. McGraw-Hill Book Co., New York City.

This book is designed for the artist, art director, advertising man, art student, printer, and all those who have to design or produce printed matter of any form.

The authors present numerous old-fashioned and modern upper- and lower-case alphabets, old and modern script, directions on how type faces are to be used, and samples of many currently used type faces.

Mathematics for the Sheet Metal Worker

By C. E. Buell. Cloth, 199 pages, 5⅜ by 8⅛ in., illustrated. Price, $2. Pitman Publishing Corp., New York City.

A book for the practical man or for trainees in the field of sheet-metal work.

It contains a review of the common arithmetical operations; methods of laying out angles, lines, and figures; formulas; measurements; bend allowances, areas, volumes, and weights; graphs; template developments; shop trigonometry; determination of irregular areas and volumes; strength of materials; and ventilation computations.

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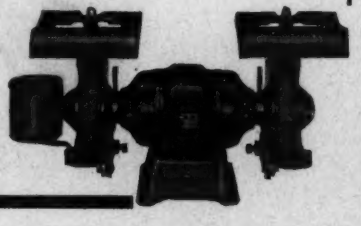

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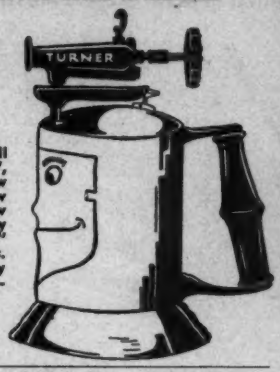

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Atlas Press Company, The 7A
Badger-American Electrotype Co. 42A
Baldor Electric Company 40A
Behr-Manning Corporation 24A
Black & Decker Mfg. Co., The 5A
Boice-Crane Company 28A
Bradley Washfountain Co. 32A
Brodhead-Garrett Co. 44A
Bruce Publishing Company, The ..... 3rd Cover
Burrill Saw & Tool Works 36A
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Chicago Wheel & Mfg. Co. 40A
Cincinnati Tool Company, The 14A
Columbian Vise & Mfg. Co. 12A
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Delta Mfg. Company 23A
Dietzgen Company, Eugene ..... 2nd Cover
Disston & Sons, Inc., Henry 21A
Ditto, Incorporated 33A
Doall Company, The 4A
Driscoll & Co., Martin 42A
Dumore Company, The 34A
Eisler Engineering Co. 42A
Elcraft Div. Educational Labs. 42A
Engineering Sales Company 40A
Foley Lumber Company, T. A. 42A
Foley Manufacturing Co. 37A
General Finishes Sales & Service Co. 36A
Guillow, Paul K. 40A
Hammett Company, J. L. 43A
Heller Bros. Company 30A
Higgins Ink Co., Inc. 43A
Hobart Brothers Company 43A
Indianhead Archery & Mfg. Co. 42A
Jam Handy Organization, The 27A
Kearney & Trecker Corp. 31A
LeBlond Machine Tool Co., R. K. ..... 4th Cover
Lee Co., K. O. 8A
Lewis Machine Tool Co. 38A
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Lussky, White and Coolidge 42A
Manual Arts Press 41A
McGraw-Hill Book Co., Inc. 16A
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Post Company, Frederick 16A
Pratt Agency, G. A. 40A
Racine Tool & Machine Co. 6A
Reading Electric Company, Inc. 42A
Rhodes Mfg. Co. 8A
Russell Electric Company 43A
Russell-Jennings Mfg. Co. 12A
Schollhorn Co., Wm. 40A
Sheldon & Company, E. H. 22A
Skilsaw, Inc. 11A
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STOP
STOP YOUR MACHINE BEFORE YOU -
1. Caliper your work
2. Clean chips from work or tool
3. Oil or wipe machine
FASHION NOTE - No. 1
Save your eyes. They're the only pair you have. Wear goggles when your operation makes the chips fly.
FASHION NOTE - No. 2
Jewelry is excess baggage. Don't wear rings, wrist watch, or pocket chain. You might get in the whirl of things before you know it.
HOLD TIGHT
Mount work securely, clamp as close to tool post as possible. Be sure tool is in correct position.
WATCH YOUR STEP
See that the floor around your lathe is always clean. Keep oil wiped up. It's slippery. Don't let chips and shavings pile up. Don't let your mind wander.
FASHION NOTE - No. 3
Don't feature a collegiate drape shape in your work clothes. Wear tight fitting clothes with no tie, or tie tucked in. Roll up your sleeves.

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